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CHARLES W. PRICE . . . . . PRESIDENT AND EDITOR
STEPHEN H. GODDARD . . . . . SECRETARY AND MANAGER
WM. HAND BROWNE, JR. . . . . TECHNICAL EDITOR
AINSLIE A. GRAY . . . . . MANAGING EDITOR

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THE AMERICAN ELECTROCHEMICAL SOCIETY MEETING.

The meeting of the American Electrochemical Society, held at Philadelphia, May 2, 3 and 4, was undoubtedly one of the most successful which this society has had. This is exceedingly gratifying, since the preceding meeting, held at New York city, was poorly attended and created but little interest; in fact, the result of that meeting aroused grave doubts whether the society could continue to carry on its useful work. The Philadelphia meeting has dispelled all fears in this respect, and will be remembered by those who attended it with pleasure.

The programme was, as usual, full. This, no doubt, is a disadvantage, since it crowds the sessions and curtails discussion. It seems likely, however, that if there were not a good programme presented that the attendance at the meetings would be far from satisfactory. It is a difficult problem to decide upon how many papers are to be presented at such meetings, and it would seem that more discrimination might be exercised in this matter. This, however, is a common fault of nearly all conventions. It should be said that among the papers which were presented at this meeting were a number of unusual value.

The critical condition in which the society seems to be makes important careful consideration of the plan suggested by the American Chemical Society. This is that the two societies unite in publishing a monthly journal which will contain the papers presented to both. Although the interest and enthusiasm shown at the Philadelphia meeting seem to indicate that the crisis is past, this proposal should nevertheless be given careful thought. It has many things in its favor, and, of course, entails certain risks and disadvantages. The American Electrochemical Society has done good work: it has put into print much valuable material which would not otherwise have been published. In this way it has justified its formation. Those who have been closely identified with it necessarily feel a certain amount of sentiment in continuing it, and they dread lest such cooperation may weaken it and ultimately result in its disbanding. The problem is rather difficult to solve. The points which should be borne in mind are: In what way will the greatest good be accomplished? How may the science and the arts to which it is devoted best be carried forward? And a minor, but nevertheless important, consideration, How may the expense of doing this be reduced? Certainly the publication of a joint journal by the two societies would reduce the total cost and each society would have the support and cooperation of the other. But, since the tide now seems to have turned and is flowing in the right direction, the first consideration is the most important. The object in founding the

society was to advance the science and application of electrochemical and electrometallurgical processes, and it should be with the object of carrying out this plan that the decision should be made.

MACHINE TELEGRAPHY.

The paper read at the recent meeting of the American Institute of Electrical Engineers, on the occasion of the dedication of the Engineering Societies Building, by Dr. Louis M. Potts, calls attention again to the slowness with which rapid systems of telegraphy are making headway. This is particularly true in this country, for machine systems are more widely used abroad than here; but it should be said that the telegraph companies of this country are not entirely neglecting the newer systems of telegraphy, for each of the two large companies is now using some such system to a certain extent, and in this way is trying it out in comparison with the old Morse system. However, these installations are rather experimental, and can not be looked upon as the beginning of a general transformation.

This condition seems rather extraordinary, at first sight, because all other electrical industries have made rapid progress and, as used to-day, bear scarcely a resemblance to the systems as first brought out. The telegraph, on the other hand, is most widely used in the simple manner devised by Morse. It is well to point out, nevertheless, that the conditions in the telegraph field are somewhat different from those in the other fields. Moreover, although we have to-day large high-speed electric trains, we still use in the outlying districts the primitive horse and cart; and the automobile, while increasing rapidly in numbers in the large cities, will not, for a long time to come, become a serious competitor of the horse in the rural districts. In other words, the suitability of more elaborate systems depends upon the amount of traffic and the road over which it must be transmitted. If this traffic be too light to warrant the building of an expensive road, the primitive system must remain. So, in the telegraph field, where the traffic is light the simple and inexpensive methods must remain. The point at which it becomes economical to make a change depends upon many things. The most important of these is, of course, the average number of messages which must be transmitted.

When comparing the rate of transmission of messages, the machine systems are far ahead of the Morse. For example, the Rowland system, which was described by Dr. Potts, can send sixteen messages over one line while the simple Morse system is sending one. As far as the time of transmission is concerned, there is but little gained, since the time required to send the message over the wire is but a small part of that expiring between the handling of the message and its delivery, and this time can be shortened appreciably only by increasing the number of receiving and delivery stations. It is true that a rush of messages might be handled more expeditiously by the machine, but if the facilities for distributing these from a receiving station be not any better than they are now, little will be gained.

The chief advantage of the machine, then, seems to lie in the saving of additional circuits. For a given number of messages one circuit will be equivalent to, say, sixteen where the Morse system is employed. The cost and upkeep of the machine must then be balanced against the cost and maintenance of fifteen additional lines. Another point is a possible reduction in the number of operators required; but this will be somewhat lessened by the expert mechanicians necessary to keep the machines in operation. It does not seem likely that inexperienced typists would take the place of the trained operators. It is more likely that the latter would be trained to run the new machine. Under good conditions, only one-fourth the operators of the Morse system would be required, but it is more likely that the reduction would be only one-half or less.

Bearing these facts in mind, and with some data upon the reliability and cost of maintenance of the machine, it should not be difficult to determine under what conditions it would be economical to install it in place of the Morse system. It seems very probable that, while there are a great many routes over which such systems could well be used, perhaps it would be more economical to continue handling the bulk of messages by the old system. Nevertheless, one can not suppress a feeling that applied telegraphy should do more than mark time. The competition of the telephone for short and moderate distance communication is becoming more serious, and the recent increase in telegraph rates will not lessen this. On the other hand, the economies of the machine system are greatest for long-distance transmission.

BOSTON EDISON COMPANY EXPLAINS RATE PROBLEMS.

At a hearing before the Gas and Electric Light Commission of Massachusetts on April 29, Mr. E. W. Burdett, of the Boston Edison Company, presented an exhaustive explanation of the central station rate problem in answer to questions asked by the Public Franchise League. The general theory of rates, division of expenses and wholesale discounts as practiced in Boston were discussed at length.

Mr. Burdett pointed out that electric lighting costs are based upon two almost equally important factors; first, the length of time which a given demand is used; and second, the size of the individual demands. The demand refers to the number of units called for by the customer at any one time. It is not generally realized how large a factor in the cost of electricity is the necessity for having a plant large enough to supply the greatest number of kilowatts which may be called for at any one time. During the year 1906 one-half the plant of the Boston Edison Company did approximately ninety-seven per cent of the work, the other half of the plant being required to handle the three per cent of additional business which came at the time of the winter peak load. A large percentage of that part of the cost of supplying current which is therefore composed of such items as interest and depreciation could be cut off if the company was not obliged to keep a sufficient plant ready to take care of the peak load.

As a public-service corporation, the company can not select

the customers to whom it will sell its product, and it must, therefore, as a matter of mutual justice, be allowed to apportion its expenses among the customers or different classes of customers responsible for the respective portions of these expenses, and this is one reason why the electric lighting costs of being ready to supply current should be high as compared with the cost of actually producing the current. The storage of electricity is, in the ordinary sense of the word storage, entirely out of the question. There is no alternative but for an electric-light company to equip itself with a plant large enough not only to manufacture and deliver the greatest output which it may be called upon to supply to existing customers, but also to take care of the factors of business growth and safety in the form of reserve capacity. This is the fundamental reason for a differential rate tariff in electric lighting.

There are two classes of expenses in the business. The first is those items which are entirely independent of the amount of current sold, and the second, those items which are regulated by the number of kilowatt-hours called for. In addition to the expenses dependent upon the size of the plant, the first item should include general expense, including management, accounting, purchasing, canvassing, insurance and taxes, meter department, care of street system, the labor connected with the stations, part of the coal, etc.

The expenses which are entirely independent of the number of kilowatt-hours are very much in excess of those expenses directly dependent upon the latter, so that unless these two classes of expense are treated differently it will usually result in shifting the burden caused by one set of customers almost entirely to the shoulders of another set. This unjust condition is avoided as far as possible by the system of charging. Mr. Burdett explained this point by assuming that the total cost of supplying the company's customers in a given period were to be divided by the total energy consumption, making an average charge to be paid by each per kilowatt-hour. As the size of plant increased with the increase of the variable demand, the fixed charges would increase and so the average rate, imposing new burdens on the original consumers. Mr. Burdett stated that the diversity factor, or the ratio of the sum of the customers' demands to the actual station demand, is 1.5 for lighting and 4 for power, the result being a very much lower primary charge per kilowatt-hour for power.

In regard to wholesale discounts, Mr. Burdett pointed out that their use is solely because of the actual difference in cost to the company between the large and small consumers. The company believes that the distributing cost necessary to supply any given large customer will be more than offset by the greater economy of its efficient generating plant over that of the smaller plant of the customer. The costs of an electric-light company are actually the sum of what its customers' costs would be if they supplied themselves for the different conditions under which they consume current, less such deduction as is justified by the greater economy of the company's larger plant. Perhaps the most important difference relates to the system of street distribution, which is practically one-half the company's total investment. While it would be difficult to determine exactly the proportion necessitated by the immense number of small customers, the company is satisfied that this proportion is not less than from eighty to ninety per cent of this investment, involving not only the operating expenses connected with it, such as inspection, the majority of the repairs, transformer losses, etc., but the interest on the investment, depreciation and taxes.

THE "PINCH" PHENOMENON.

In the ELECTRICAL REVIEW for May 4 reference was made to an interesting article by M. Paul Bary, which discussed a peculiar phenomenon noticed when liquid or gaseous matters were carrying comparatively heavy currents. The conductor shows a tendency to contract, and may eventually separate, thus opening the circuit. At the recent meeting of the American Electrochemical Society a paper on the same subject was read by Mr. Carl Hering. It seems that some time ago he noticed this phenomenon while operating an electric furnace. A cleft appeared in the column of molten metal, eventually extending to the bottom and breaking the circuit. The metal "froze," necessitating the taking down of the furnace to set matters right again. The explanation offered is practically the same as that given by M. Bary. Mr. Hering prefers, however, to think of the contraction as being due to the magnetic lines surrounding the conductor. He points out that there is always risk of this when operating electric smelting furnaces, and that care should be taken to prevent it.

It frequently happens, however, particularly in electrical industries, when any unusual difficulty is encountered some one manages to turn this to advantage. In this particular instance Dr. E. F. Northrup has utilized the "pinch" phenomenon, as Mr. Hering calls it, for constructing a beautifully simple ammeter. A mercury channel is arranged, having a number of contracted sections, which increase the tendency for this phenomenon to occur. When a current is passed through the column contracts at these points, and thus forces up an indicating column resembling the column of a barometer.

Although the explanations offered are both simple, the mechanism by which this is brought about is not altogether clear. For many years, though most elaborate and delicate experiments have been made to determine whether any elongation does take place along lines of force, no satisfactory results have been secured, so that the complementary action to which is attributed this effect was not suspected of being able to produce such striking results.

CENTRAL STATION MEN: ATTENTION!

The National Electric Light Association, through its membership committee, is campaigning for a record attendance at the thirtieth convention, to be held at Washington, D. C., June 4, 5, 6 and 7. One of the big features of the meeting will be "New-Business Day." Central station men: Attention!

American Electrochemical Society.

Eleventh General Meeting, Held at Philadelphia, Pa., May 2, 3 and 4.

THE eleventh general meeting of the American Electrochemical Society was held at Philadelphia, Pa., May 2, 3 and 4, at the John Harrison Laboratory of Chemistry, University of Pennsylvania. After a meeting of the board of directors in the morning at 9 o'clock, the general session for the reading and discussion of papers was opened at 10 o'clock, with President Carl Hering in the chair.

The society was welcomed to the university, in the absence of Provost Charles C. Harrison, by Dr. Edgar F. Smith, vice-provost and professor of chemistry. At the concluding session Provost Harrison was introduced and addressed the society briefly, expressing his interest in its work and the pleasure the university had in receiving the members as its guests.

President Hering presented the presidential address, which took the form of a discussion of the work accomplished by the society since its organization. Diagrams were exhibited which showed graphically the progress which had been made, which, with the exception of a setback last year, has been gratifying. The curves indicate that a stable condition is being approached; that not much increase in membership is to be expected, and that the income will be sufficient to meet all ordinary expenses. A comparison was made of the growth of the two European societies—the Bunsen Society, of Germany, and the Faraday Society, of Great Britain, which showed that the American society had made more rapid progress than either of the others.

A matter of considerable interest and importance to the society is a tentative proposition suggested by Dr. W. A. Noyes, and made by the American Chemical Society. Briefly stated, this is to combine in one monthly publication all papers on physical chemistry and electrochemistry read before either society, the object being to reduce the expense of publication to both societies, and to secure to the members of each the papers read before both. It is proposed also to combine the *Journal of Physical Chemistry* with this new joint publication. President Hering thought that such cooperation would be of great benefit to all concerned. It would reduce the expenses of both, and would result in a publication of more value to those receiving it. Every one would gain, and no one would lose, and the question therefore seemed to be not so much whether the plan should be carried out as whether it could be carried out. The most important phase of the problem, which is somewhat complex, is how the expense is to be divided. For such an arrangement to be permanent it should be equitable to all concerned, and the division of expenses for the future should not be based upon present conditions. Moreover, the individuality and independence of the two societies should not be affected by such joint publication. President Hering suggested that the two societies jointly organize a bureau of publication, which should receive all the material of both societies for publication. Each society should collect and edit its own papers and discussions at its own expense. The bureau of publication should print and supply to each society the number of copies asked for. The expenses of the bureau should be divided into three parts—those for typesetting, cuts, etc.; those for printing and binding, and general expenses. The expenses for typesetting should be borne by each society in proportion to the amount of matter contributed. The expenses of printing should be divided in proportion to the number of copies asked for, and the general expenses in the same proportion as the sum of the first two.

On account of the unusual interest in the matter brought up by the president's paper, it was laid before the society for discussion.

Dr. W. D. Bancroft said that the securing of enough papers to make a respectable volume of transactions would not keep the society alive. The situation at present is somewhat critical, and he believes that the suggestion for a joint publication of the transactions of the two societies comes in the nick of time. The division of expenses is the chief difficulty. The suggestion of the American Chemical Society was that the American Electrochemical Society pay $3 for each member, and receive twenty-five cents for each member of the American Chemical Society who takes the double transactions, but is not a member of the former society. By this arrangement the electrochemical society can not lose, so that the financial side becomes easy. However, there are other things to be considered.

President Hering pointed out that at present the transactions do not cost the society $3 for each member, and the sale of extra copies printed brings in about $600 a year.

C. J. Reed said that care should be taken not to make an arrangement which could be easily terminated, and leave either society in the lurch.

A. V. Isakovics thought that such an arrangement would stop the growth of the American Electrochemical Society, and that the society should not enter into the arrangement proposed hurriedly. It would be better to hold the matter under consideration for another year.

C. F. Burgess did not think the plan desirable. If the society should stop the publication of its own transactions it would lose its identity.

Elmer A. Sperry moved that the matter be placed before the members of the society and that the latter be asked for an expression of opinion by means of a letter vote. The motion was carried.

The reports of the officers were presented by the secretary. The secretary's report shows that the balance on December 31, 1906, in cash and bonds was $2,307.69. The treasurer's report shows that the income for the year 1906 was $4,954.28; the expenses, $4,635.34, leaving a cash balance of $318.94.

The tellers' report on the general election was then presented. The following officers were announced as elected:

President—C. F. Burgess, Madison, Wis.

Vice-presidents—C. E. Acker, Niagara Falls, N. Y.; A. H. Cowles, Cleveland, Ohio; W. H. Walker, Boston, Mass.

Managers—E. F. Roeber, New York city; S. S. Sadtler, Philadelphia, Pa.; L. Kahlenberg, Madison, Wis.

Treasurer—P. G. Salom, Philadelphia, Pa.

Secretary—J. W. Richards, Bethlehem, Pa.

W. R. Mott then read a paper entitled "Some Efficiency Considerations of an Electrolytic Cell." Attention was called to the desirability of rating electrochemical processes rather by their energy efficiency than the current efficiency, as is now frequently done. Adopting this plan, three cases may be considered: First, when the current efficiency is 100 per cent. In this case the reaction begins with the first passage of current through the solu-

tion, and the volt-ampere characteristic is a straight line, the voltage rising as the process proceeds. In the second case the desired reaction does not take place until a certain drop of potential exists across the cell. The current therefore rises with the voltage up to this point. The efficiency is zero at first, then rises and increases with increasing current. The volt-ampere characteristic shows a sudden increase in voltage at the point where the desired reaction begins. The efficiency of this process is given by the equation $e = \frac{c-a}{c}$ where c is the working current, and a the current which must be passed through the cell before the reaction begins.

Case 3 is that in which the reaction does not take place until a certain voltage has been reached. As the current be further increased a point is eventually reached where a second reaction may occur. The volt-ampere characteristic of this process shows two steps, and the efficiency curve has two parts. It is zero up to the point where the first and desired reaction begins, increases until the second reaction starts, and from there on decreases. The efficiency of the process while the desired reaction is taking place is given by an equation identical with that for case 2. For the second part of the process it is given by the expression $\frac{b-a}{c}$, b being the current value at which the second reaction begins. The author suggests that it is desirable in electrochemical reactions to express the amount of corrosion occurring in terms of the current density. In practice the curves shown will be found to vary somewhat, being modified especially by the temperature.

J. W. Richards expressed his approval of the suggestion that the amount of corrosion be expressed in terms of the current density. He pointed out that, other things being equal, that process having the highest energy efficiency would be better than that with the highest current efficiency. He thought that Mr. Mott's method of analyzing electrolytic operations was a good one and could be followed with beneficial results.

C. J. Reed read a paper entitled "Changes of Concentration and Migration Velocities." In an electrolytic cell containing two electrodes, consider any intermediate portion of the electrolyte separated by two planes. Obviously, as many positive ions will pass out of this division as into it. The same will be true of the negative ions. There can, therefore, be no change of concentration in this portion of the electrolyte. This argument is true whether the ions be traveling at different velocities or not. The argument is applicable to any portion of the electrolyte and it is held that this shows that the change in concentration of an electrolyte during electrolysis can not be explained by assuming different velocities of the two ions.

Dr. Bancroft pointed out that Hittorf, in 1850, or thereabouts, had studied the changes in concentration of electrolytes during electrolysis, and this was some time before the new theory had been developed. He wanted to know whether Mr. Reed had proved that there is no change in the concentration. The theory had been proposed to explain changes which are known to occur.

Mr. Reed acknowledged that changes in concentration do occur, but held that these could not be explained by assigning different velocities to the two ions.

E. F. Roeber said that the argument, while it might apply to the body of the electrolyte, could not be used for those layers in the immediate vicinity of the electrode.

Mr. Reed replied that, according to theory, this layer was of molecular, and therefore practical infinitesimal, thickness, and changes there could not affect the body of the electrolyte.

Dr. J. W. Richards presented a paper entitled "The Work Done in Electrolysis." He has endeavored to find out how much work is absorbed in electrolytic action by some means not involving any assumptions of decomposition voltages. For this purpose he had placed an electrolytic cell within a calorimeter, and measured the amount of energy dissipated when a given amount of electrical energy was supplied to the cell. The apparatus was first checked by a blank experiment, in which copper electrodes and copper sulphate were electrolyzed. This gave the constant of the apparatus. The rise in temperature of the cell accounted for 78.9 per cent of the energy supplied, leaving the remainder as lost in the apparatus. He then tried the experiment with sulphuric acid and platinum electrodes, and from the data of several experiments thus obtained—correction being made for the constant of the apparatus—the energy lost, apparently in electrolyzing the solution, was found to be equal to the product of the current passing into 1.61 volts. The experiment was also tried with copper sulphate.

Replying to Mr. Reed, Dr. Richards said that a calculation of the amount of heat carried off in gases was made, and showed that this was negligible.

Dr. C. P. Steinmetz suggested that the oscillograph offered a method of determining decomposition voltages. This would show the electromotive-force at every instant that the circuit was opened and closed. He pointed out that the work of releasing the two elements as gases was included in the potential given.

Mr. Hering believed that this was properly so included.

Mr. Reed differed on this point, as it is not known whether the oxygen and hydrogen are deposited as gases or become gaseous afterwards.

Mr. Mott said that the method so frequently employed of determining the voltage of decomposition by measuring that of polarization is not reliable, as with certain combinations an insulating film is formed on the electrodes, thus creating a condenser which gives values having no relation to that of decomposition.

Dr. Richards explained that this method had been devised to obviate that usually employed of measuring the polarization voltage and allowing for the loss due to the resistance of the cell. The value given does include the work of expansion of the gases, but this is correct, since the work done is compared with the heat set free when these two elements as gases are burned to form water. However, he stated that although he had given a figure for the voltage absorbed by the reaction, he had not said anything about what this voltage was doing.

Dr. E. F. Smith, in a paper on "Recent Developments in Electrolytic Analysis," described two types of electrolyzing cell which had been developed at the University of Pennsylvania for hastening such work. It was suggested some years ago by Gibbs that a glass test tube containing mercury might be used for electrolyzing solutions such as copper sulphate, the mercury being the cathode and absorbing the copper, the acid being left behind. Dr. Smith's work has been to develop from this suggestion a useful method. They first used a large test tube with a flat bottom, into which a small piece of platinum wire was sealed. This was covered with mercury and thus gave electrical contact with the cathode. The material to be electrolyzed is placed above this, and in it is a disc cathode, usually of platinum, which is revolved in its own plane, thus stirring the electrolyte. They had found that with this apparatus metallic salts may be quickly and easily analyzed. The process does not require more than a few minutes. Some solutions which ordinarily give considerable difficulty here present no

trouble. Barium can be quickly separated from iron and other separations carried out. When the haloids are employed, a silver anode is used, with which the chlorine and bromine set free unite. This forms solid, adherent coatings of silver salt which are easily weighed and determined. As the process leaves nothing behind but pure water, there is no need to wash the anode after it is removed.

Certain solutions, particularly those containing salts of the alkaline metals, give difficulty with this simple apparatus, because the sodium and potassium may leave the mercury to react with water, forming hydroxide, and may even diffuse up to the anode. To overcome this difficulty a crystallizing vessel is used for the cell. This is partially filled with mercury and within it is placed a smaller dish without a bottom resting upon glass rods, in order to leave a free passage for the mercury below. The solution to be electrolyzed is placed within the inner dish and there stirred with a silver cathode usually having two discs. Water is placed in the outer ring. During electrolysis the alkali combines with the mercury and passes to the outer ring, where the cathode connection is made, and there combines with water to form hydroxide. It can not get back into the inner cell. The halogen unites with the silver. The latter is determined as usual by weighing the anode. The alkali is determined by titrating the hydroxide. From two to three volts are required, and about a quarter of an ampere. Separations are carried out in from thirty to forty minutes. Barium can be removed from a mixture of barium, calcium and magnesium chlorides, sodium can be removed from calcium and magnesium, and uranium from potassium and sodium. By painting the glass vessels with paraffine it is found possible to analyze fluorides, using an anode of calcium hydrate on platinum gauze.

Dr. Bancroft said that he was much interested to see the old Castner-Kelner process applied to a quantitative analysis.

Mr. Hering suggested that the method could be used for the analysis of sulphates by employing a spongy lead cathode.

C. J. Reed, in a paper entitled "Electrolytic Pickling of Steel," described a method of removing the scale from steel castings by using the latter as cathodes in an electrolytic cell. Under this condition no iron is dissolved, although the passage of the current loosens the scale so that it is easily removed. It is thought that the action is due possibly to the liberation of hydrogen under the scale, which is a partial insulator and thus acts mechanically. He found that in this way the scale which usually requires some time to remove by the ordinary pickling process can be removed in a few minutes. It is softened and loosened and easily scraped off. The process would save from fifty to seventy-five cents per ton, or about $3,000 a day in a single large factory in Philadelphia. It might be used for removing the scale from wire, but there would be some difficulty here in obtaining satisfactory electrical connection throughout the entire coil.

On Friday morning a paper on "The Estimation of High Temperatures," by George K. Burgess, was read. The author reviews the work which has been done to fix certain high temperatures for calibration purposes. He gives the results of experiments to determine the fusibility of various metals. The results of various experimenters are brought together to show how closely they are in agreement. The work has been done in various ways, by thermoelectric estimation of melting points and by optical estimation. He concludes that although a good deal has been done in the field of pyrometry of precision, there is still an almost unexplored region of which hardly a preliminary survey has been made. Dr. Richards expressed his satisfaction at being again assured that the melting point of platinum was not far from the figure originally accepted, though doubt had been cast upon this by recent work. He said it was well not to lay too much stress upon such redeterminations until they had been verified by various observers. He asked whether the metallic vapors set free in fusing metals would not interfere with the observations by means of the optical pyrometer.

Mr. Burgess said that this caused the greatest uncertainty.

Dr. Steinmetz said that an interesting point was raised concerning the melting point of chromium. He had found considerable difficulty in melting chromium prepared by the Goldschmidt process, and questioned the value given in the paper.

Mr. Burgess said it was in doubt, but that they had found that when the oxide was removed from the metal it did melt.

Dr. H. N. Potter said that the sending of a blast of inert gas through the melting apparatus immediately before observing the temperature by means of an optical pyrometer removed the trouble due to the metallic vapors.

Dr. S. A. Tucker said that this method had been used and found to answer well.

An address on "Electric Conduction" was delivered by Dr. C. P. Steinmetz. He considered electrical conduction in general. When power flows through a circuit phenomena take place outside as well as inside the conductor. There are conditions of stress set up both electrically and magnetically. Inside the conductor heat is developed, which is attributed to the resistance of the conductor. In studying such phenomena it is beneficial to divide them into three classes. The first of these is metallic conduction. Here the action of the conductor seems to be rather negative, and the conversion of the energy into heat alone takes place. Light may be developed, but this is produced indirectly, and is the result of the temperature only. Conductors of the metallic class cover but a narrow range. The resistance is approximately constant for a constant temperature, and it rises slightly with the temperature, following approximately a straight line. The temperature-resistance characteristics of different metals all point towards the same point—absolute zero. Alloys behave but slightly differently from the pure metals. As a rule, their temperature coefficients are less, and sometimes they are negative.

The second class of conductors are the electrolytic. The conduction is accompanied by chemical action. The resistance as compared with the metals is about a million times higher. These conductors may be solutions or fused salts. They cover a great range in resistance. The temperature coefficient as a rule is negative, but follows a straight line. It is often convenient, in studying such problems, to construct a volt-ampere characteristic of the material. The ideal characteristic is a straight line, indicating that the resistance is independent of the current flowing. A metallic conductor, due to its temperature coefficient, has a characteristic rising above the ideal; for electrolytic conductors it falls below.

The third class of conductors includes gases and vapors. Regarding these much theoretical and speculative work has been carried out recently. This work attempts to explain the conduction of the current by convection currents. This idea is useful, but is not thought to be an explanation of facts. It is crude, and the speaker thought that it would be discarded or amended. He did not wish to attack it, but pointed out that there are so many sources of error in studying such phenomena that it is advisable to avoid all possible misleading ideas or speculations.

When conduction takes place through vapors the current may pass by means of the vapor surrounding the electrodes. This is the Geissler tube effect. Or it may make its own conductor by vaporiz-

ing material from one of the electrodes, thus forming a true arc. By means of a highly exhausted tube containing mercury and several points by means of which contact could be made, the difference between the two kinds of gaseous conduction were shown. By sending a high-potential alternating current through the tube the ordinary Geissler effect was observed. The voltage was high, the current small, and passed through the gas contained within the tube. At the same time a direct current was caused to flow between two other electrodes in the same tube. The difference is very striking. The arc formed in the latter case was continuous. In the first case the gas was faintly luminous, and showed decided striations. By passing an oscillating discharge between the electrodes which were carrying the high-tension alternating current, the conducting column became much more brilliant. The speaker said that although most of the speculative work had been done on Geissler tubes, but little is actually known regarding it. Much more satisfactory work has been done with arc conduction.

An experiment was then shown, in which a 200-volt arc was struck between two carbon electrodes. With a direct current the unprotected positive carbon consumes much more rapidly than the negative, but by enclosing the carbons the wasting away is very largely reduced. This experiment shows that it does not necessarily follow that the carbon rod furnishes the vapor. Its loss may be due merely to combustion. A magnetite arc was then shown with a negative carbon rod. The arc was in all respects similar to the ordinary carbon arc. Reversing the arc and making the magnetite electrode negative gave the characteristic brilliant white magnetite arc. Replacing the carbon positive with a copper positive caused no difference whatever in the arc formed. These experiments showed that the conducting vapor came from the negative, and not from the positive, electrode. By placing from 600 to 700 volts alternating current across the two electrodes it was impossible to start an arc, although a spark could be caused to pass. The speaker said that if the voltage were raised to 1,200 a small, short arc might be formed between magnetite and copper. In general an alternating current can not maintain an arc. Carbon, it happens, is an exception to this rule. The materials of the vapor stream come from the negative terminal. At each reversal of the current this stream is stopped and a new arc must be started. The voltage must be sufficient to cause the spark to pass through the vapor. If the striking distance is less than that length of arc which the material can support when raised to the boiling point, the alternating arc will not be formed. This point decreases with an increase in temperature, and it happens that with carbon the striking distance is sufficient to start the arc at each reversal. Stroboscopic photographs shows this effect very clearly, a spark passes at each half-wave.

A magnetite lamp was then shown, the electrodes being separated some distance. By taking a smaller electrode connected through a high resistance to the negative electrode, it was shown experimentally that it is easy to start the arc by touching the negative electrode and lifting the wire up to the positive; but it was impossible to start it by reversing the operation. In other words, the conducting vapor is furnished by the negative electrode, and by starting the arc there it is easy to carry it over and attach it to the positive. Touching the positive electrode with the wire forms a small arc, but the wire itself is then furnishing the conducting vapor, and the arc can not be transferred to the cold negative electrode. This experiment suggests a vapor rectifier, the intermediate electrode being of magnetite, the other two being of copper. This rectifying action is a universal phenomenon of the arc. It is for this reason that alloys are employed for lightning-arrester electrodes, these being selected so that the arc will not persist.

The amount of vapor in an arc is proportional to the cross-section and is proportional to the current. The circumference of the arc is proportional to the square root of the current; therefore the surface of the arc is proportional to the l[illegible] and to the square root of the current. The equation for power then becomes $EI = CL\sqrt{I}$, C and L being, respectively, circumference and length of arc. This may be reduced to the form $E = \frac{CL}{\sqrt{I}}$. The equation is approximately true for actual conditions. The resistance of the arc is then equal to $R = \frac{E}{I} = \frac{CL}{I\sqrt{I}}$; the resistivity, $r = \frac{B}{\sqrt{I}}$, in which B is a constant depending upon the vapor pressure and the materials.

There is also a drop of potential at the electrodes, where an amount of energy is absorbed proportional to the current. This drop is approximately constant for all materials. For hydrogen it is about thirteen volts; for cadmium, sixteen volts, etc. The specific resistances of air and the vapor of the arc are not very different. More recent work with the Geissler tubes has shown that the specific resistance of them is about in the same range as that of the arc and of electrolytic conductors.

Although it is often convenient to classify the various phenomena in any field of investigation at the beginning, as knowledge increases it is found that these classes do not remain sharp, and that frequently they seem to overlap. One phenomenon which will be placed by one observer in one class will be placed by a second observer in another. Further, as knowledge advances still further, the classes seem to merge. Usually it happens that the most striking phenomena are those observed first, and these are usually those in which some one feature predominates over the others.

There is another type of conductor, designated by the speaker as "pyro" conductors. These are those in which the conductivity seems to be a combination of metallic and electrolytic. Metallic silicon is an instance of this kind. The resistance of this material increases with the temperature until a certain point is reached, when it falls rapidly, and from that point on continues to decrease. Certain compounds behave about in the same way, and it is thought that the Nernst glower is a conductor of this kind, and not an electrolytic conductor, as has been asserted. The characteristics of these compounds vary with the compound, and may show two points of inflection. In certain of these compounds the characteristic first rises, and then falls. Sometimes it may again begin to rise, although to obtain the last part of this curve may require a supply of artificial heat to raise the body to a sufficient temperature. Of course, after a material is melted it may be classed as an electrolytic conductor, but there are certain substances which first pass through a viscous state, and it is impossible then to say when they cease to act as a solid conductor and begin to act as a liquid.

Classes, as a rule, are rather types than distinct divisions of a subject. One material may exhibit the characteristics of two or more of these types. Carbon, for example, usually has a negative temperature coefficient. If heated sufficiently high it becomes what is known as metallized, and then has a positive characteristic. Insulators may not be placed in a class by themselves. They are a mixture of types, and generally follow the "pyro" characteristics. The whole field of conductors is exceedingly interesting, and investigations, particularly with materials on the border lines between the classes defined, should be of considerable value.

A paper by R. C. Snowden, entitled "Electrodeposition of Zinc," was read by Dr. Bancroft. This describes an investigation to determine the conditions most suitable for the electrodeposition of zinc.

It was found possible to obtain good deposits of zinc from acid or alkaline solutions, often at such high current densities as sixty amperes per square decimetre. The rate of rotation of the cathode has an enormous effect upon the upper limit of current density. Zinc can be precipitated readily from strong alkaline solutions with a high-current efficiency. More finely crystalline deposits are obtained from alkaline than from acid solutions, and increasing the temperature increases the size of the crystals. Increasing the current density decreases the size of the crystals, as does also the presence of formaldehyde.

President Hering presented a paper entitled "A Practical Limitation of Resistance Furnaces; the 'Pinch' Phenomenon." This described an effect observed by Mr. Hering when working with electric furnaces. When a heavy current is passed through a column of molten metal, under certain conditions this mass suffers contraction, a cleft appearing in the column as though it were being pinched by unseen fingers. Under certain conditions Mr. Hering observed a valley of this kind about six inches deep in molten iron. The effect increased until the mass was entirely separated and the molten material thrown up and the electrodes solidified, necessitating the taking down of the furnace. Mr. Hering attributed the effect to pressure caused by the surrounding lines of force. He brought the matter to the attention of Dr. E. F. Northrup, who studied it analytically and showed that the theory was in agreement with Mr. Hering's explanation. Dr. Northrup also suggested that by considering a column of conducting material to be made up of a number of conducting filaments, the ampere effect would tend to draw these together, and the action might be explained in this way. The phenomenon is interesting and directs attention to a possible limitation of electric furnaces. To avoid it it is desirable, according to Mr. Hering, to supply the heat by means of a solid resister. If this is not possible the column of molten material should be of uniform thickness throughout, as the contraction tends to start at that point where it is narrowest. It also suggests that the best type of furnace to avoid this would be one in which the column was short, deep and narrow; but, unfortunately, this is not a thermally efficient type. Dr. Northrup has made use of the phenomenon to construct a simple ammeter equally suitable for alternating and direct currents. By arranging the apparatus so that a number of these contractions occur in series, the column of mercury is made to rise about thirty inches. An ammeter of this kind was on exhibition at the laboratory.

A paper entitled "The Action of Carbon on Magnesia at High Temperatures," by O. P. Watts, was read, in the absence of the author, by C. F. Burgess. While working with an electric furnace a deposit was observed on the magnesia lining. This, to all appearances, was lamp black. The electrodes used were of pure Acheson graphite. An analysis of them showed no impurities, and an analysis of the deposit showed that it was uniform in position. It consisted of carbon, manganese and oxygen. The author, from his study, was led to the opinion that it was merely a physical impurity, though Professor Burgess said that he himself was not so sure of this, as it might be a chemical compound. When burned in a calorimeter, however, a certain amount of heat was developed which seemed to correspond to the heat of combustion of carbon. The explanation offered was that the magnesium and carbon unite to form a carbide, and at a higher temperature they vaporize and are dissociated, leaving the magnesium to take up oxygen and carbon. The phenomenon is important, since it gives rise to pits in the crucible.

Professor Richards thought that the explanation offered by Dr. Watts was correct, as it was hardly possible that a compound was formed.

Dr. Potter said that under certain conditions magnesia would be deposited and carbon monoxide formed, which, at high temperatures, is very stable. At other temperatures, however, the reaction may go the other way.

A paper was read by W. H. Walker, entitled "Influence of Strain on the Corrosion of Iron." The author has investigated the decomposition electromotive force of various samples of iron while under strain. It was found that whenever a strain was applied to the material there was a sudden rise in voltage, then a fall, until the potential came back to about the original point. This rise occurred whenever the strain was applied. The temperature was noticed, and to eliminate this effect the material was heated by an external source. This heating gave rise to no such values as were observed when the strain was applied. The rapidity with which it was applied determines the electromotive force set up. It is concluded in this investigation that as the material adapts itself to the strain, the electromotive force returns to the normal, and that therefore there need not be any fear of unusual corrosion of iron due to strains.

On Saturday morning a paper by J. A. Wilkinson and H. W. Gillette, entitled "Polarization Voltages of Silver Nitrate Solutions," was read by Dr. Bancroft. It describes a careful investigation of this subject, care being taken to determine the effects of temperature, of the concentration of silver nitrate, nitric acid and of water. It was found that the polarization voltage of acidified silver nitrate solutions may be made to vary from 0.625 volt to 1.05 volts. This varies with variations in temperature, with the concentration of silver nitrate, nitric acid and water. The temperature coefficient is approximately 0.8 millivolts per degree. A decrease in the concentration of silver nitrate increases the polarization voltage, if the concentration of nitric acid be constant. A decrease in the concentration of nitric acid decreases the polarization voltage, other things being constant. It also decreases if the concentrations of silver nitrate and nitric acid are decreased in the same ratio.

C. F. Burgess read a paper entitled "Rapid Measurement of Electrolytic Resistance." This describes an instrument designed to take the place of the usual hydrometer for use in electroplating vats. It consists of a tube of glass with one electrode at the bottom, and another suspended by a rod, so that it is adjustable. The apparatus is connected in series with a high-resistance voltmeter, a battery and a short-circuiting key. To take a reading the tube is inserted in the electrode, with the movable electrode fixed at some point. With this device short-circuited the voltmeter is read, then the circuit is opened, and the resistance of the column of electrolyte introduced. A second reading of the voltmeter shows the effect of the increase in resistance due to the electrolyte. This may be easily calculated. To avoid the effect of polarization it is desirable to use electrodes of such materials as will reduce this to a negligible quantity, or by varying the position of the adjustable electrode, two or more readings may be obtained, and the effect of polarization thus eliminated. The apparatus may be modified so that it may be placed in a pipe, through which the electrolyte is flowing, and thus measure the resistance at that point.

Mr. Hering suggested that the apparatus lent itself to a simple substitution method. Insert a variable resistance, such as a plug box, to take the place of the voltmeter resistance. Let a reading be taken with a movable electrode at one point. Change the position of this and then change the variable resistance until the voltmeter is brought back to the same reading. Then the resistance of a column of electrolyte equal in length to the distance through which the electrode has been moved is just equal to the change which has been made in the external resistance.

Professor Burgess said that while his apparatus was suitable for this method, it had been devised for the purpose of doing away with the latter. The calculation required is very simple, no apparatus being necessary besides the voltmeter.

Dr. H. E. Patten presented a paper entitled "Energy Changes Accompanying Absorption." This gave a review of the investigations carried out in this subject. It had been found that the concentration of solution taken up by an absorbing body was not proportional to the concentration of the solution itself. It is suggested that the effect might be due to a sort of surface effect, in addition to the ordinary penetration of the material, due to the porous nature of the absorbent. By studying certain jells, as the water was extracted from them they remained clear until a certain point was reached, and then became translucent. This was thought to indicate that they were cellular in structure, which was in agreement with the explanation just given. It was thought that there might be some hint in this work for explaining solid solutions. A good

review of the bibliography of the subject was added to the paper.

Dr. Bancroft could not agree with the suggestion that anything in the work which had been done would aid in explaining solid solutions, as there is nothing there similar to surface tension.

H. G. Morris described a centrifugal vaporizing device designed for the rapid production of dry vapors. The wet steam, as it comes from rapid evaporation is passed through a centrifugal drier, which throws out all the entrained liquid and passes on the steam dry. The apparatus is suitable for rapid evaporation, is used to a considerable extent in Europe, and is now being employed in this country for concentrating liquids.

A paper by Gustave Gin, on "The Electrolytic Production of Titaniferous Iron Ores," was read by Dr. Richards. This describes the results of experiments in reducing certain titaniferous ores in the electric furnace. These contained from sixteen to thirty per cent of titanium oxide. In one case the energy required was 2,850 kilowatt-hours per ton. In a larger furnace the figure would not be over 2,280 kilowatt-hours per ton. The iron produced in this furnace contained one-tenth per cent of titanium, a trace of phosphorus, and less than one per cent of silicon. It is concluded that the reduction of titaniferous ores in the electric furnace presents no special difficulties, and that pure iron can be obtained commercially therefrom in regions where ore is near abundant and cheap power.

Dr. S. A. Tucker presented two papers, one entitled "Granular Carbon Resistance Furnace," and the other, "The Tube Furnace for Temperature Measurements." The first describes a furnace in which the resister in granular carbon. Crushed coke is most suitable for this. The material is packed within a heat-insulating wall, the current being led in suitable electrodes. Fresh coke is good for this purpose, and after use the resistance increases. When charging the furnace for the first time it is necessary to go slowly, so as to allow for this change in resistance.

The second paper describes a furnace consisting of a carbon tube, within which the material to be studied was placed. The tube was held in water-cooled clamps surrounded by some insulating material. Petroleum coke gives good results, as this protects the tube from the air and does not injure it.

Mr. Hering asked how allowance was made for the expansion of the tube as it heated.

Dr. Tucker said that by raising the temperature slowly there was no difficulty. When very high temperatures were reached it bent slightly. If necessary, however, one of the clamps could be made so as to allow for this motion.

A. T. Lincoln presented a paper entitled "Electrolytic Corrosion of Brasses." This paper had received the $100 society prize. It described a long series of investigations with brasses of various compositions, the corrosion being determined in various solutions. Curves were shown, indicating the rate at which corrosion takes place under various conditions. In some cases a high insulating film formed over the electrode.

A paper entitled "The Electrolytic Deposition of Nickel-Zinc Alloys," by E. P. Schoch and A. Hirsch, was read by the former. When the work was begun it was found that considerable difficulty was encountered in obtaining any satisfactory coatings. It was decided that before any sure results could be obtained that it would be necessary to determine the polarization electromotive force of the nickel. The work which had been done in this direction was described somewhat in detail.

E. R. Taylor, in a paper entitled "A Closed Electric Furnace for Reducing and Distilling Metals from Their Ores," describes a modification of the furnace which he is now employing for the production of carbon bisulphides, which is intended for the distillation of zinc and lead and other easily volatilizable metals from their ores. The metal is fed in at the top and works its way down around an enclosing bell, at the bottom of which is the heated molten ore. The metal distilled here rises up in the bell and is carried off into condensing chambers. Taps are provided for drawing off the slag as necessary and for cleaning the pipes, as when zinc is distilled a fine dust very quickly clogs them up. An ingenious arrangement of feed screws keeps the raw material moving and breaks up any crusts which may be formed. As this material passes down around the collecting bell it thus takes up much of the heat which would otherwise be carried off and lost in the condenser. Unfortunately, due to an accident, the furnace has not yet been tried on a large scale, but experiments on a small scale have given promising results. However, the real value of the furnace can not be determined until large-scale experiments have been conducted. The type of furnace at present contemplated is about four feet in diameter. This should produce great economies in the consumption of fuel. For the feed screws the material suggested is graphite, which should be sufficiently strong to do the work.

Mr. Sperry pointed out that in distilling zinc, conditions are such sometimes that violent explosions take place, and he thought that this matter should be borne in mind and the furnace designed to obviate it.

A paper by F. A. J. Fitzgerald and J. Forssell, on "Carbon for Electrometallurgy," was read by the former. This described an experiment made to determine the resistance of various graphite electrodes and the resistance of various types of joint. A great many data bearing on this subject were given. An interesting point was observed in the work. It was found that whenever the current was turned on the resistance of that part of the electrode projecting into the furnace fell. This, it was found, was due to the temperature of the electrode. These measurements showed that the resistivity of the connections was about 64×10^{-4}. The resistivity of amorphous carbon was 160×10^{-5}; that of graphite, 42×10^{-5}. A considerable loss of energy was found to take place by heat conduction and radiation from the electrodes. An alternating current was employed in these experiments.

Mr. Hering suggested that the peculiar effect observed might be due to induction in the voltmeter leads.

Dr. Potter, in a paper entitled "Bomb Calorimeter for Measuring the Heat of Combustion of Substances Giving Solid Oxidation Products," described a type of calorimeter devised for these purposes. The steel shell was lined with a close-fitting copper tube gold-plated on the inside. The material to be burned was placed within this, and the bomb placed in the jacket in the usual way. Ignition was caused to take place by means of a platinum spiral. This did not give good results, as the slag formed adhered to the lining. The lining was then made of some chemically inert material light enough to be weighed, so that this could be done with the material before and after combustion. The final weighing is necessary because the oxide formed protects part of the material from the surrounding oxygen and there is no other way of determining how much material has been burned. So far the work has been done with crystallized silicon, which is carefully cleaned. The average heat of combustion was found to be 7594.8 calories per gramme of silicon, which is equivalent to 215,692 calories per equivalent. The oxygen used for the combustion was obtained from the air. Electrolytic oxygen might be employed, but this would contain hydrogen, which would be more detrimental than nitrogen.

John Meyer read a paper which forms a reply to one presented at the Ithaca, N. Y., meeting by Mr. Sperry, which was entitled "Electrochemical Processes as Station Load Equalizers." In this the author analyzes the cost of production of power, and lays stress upon taking into consideration the ratio between the actual and the theoretical horse-power required in electrochemical processes. When this is done the actual amount of power used will be less than that theoretically required if the process were perfectly continuous. For this reason the fixed charges will bear a greater ratio to the total cost of power, and the latter will be higher. The author suggested that as the matter is of vital importance to electrical industries, that a committee might be appointed by the society to make a more complete study of it.

Mr. Sperry expressed his pleasure at having the subject brought up again. He said that the time has come when electrochemical processes will be operated in conjunction with commercial power supply systems. The latest United States census shows that the average load on power stations is about twenty-six per cent—that is to say, about seventy-five per cent of the machinery is idle all the time. Some industry must be developed which will fit in with these stations and utilize the idle apparatus, and in this way build up the valleys. The supply of power is becoming more and more necessary in all works, but particularly for electrochemical processes.

He believes that the power available at blast furnaces and water powers will be utilized, and then the industry will lay hold of all sources of power available. There is now available at our central stations a large amount of machinery which is lying idle. This should be used to help in supplying the demand. The suggestion that a committee be appointed to look into the problem was a good one.

E. R. Taylor said the question was one of vital importance. He thought that it is essential for any electrochemical industry to generate its own power, and not depend upon other sources; but, for the present, the industry should take whatever is available.

The paper read before the New York section at its February meeting, entitled "Power Costs," by Professor Charles E. Lucke, was read by title. This paper includes a number of discussions by F. G. Clark, Joseph Bijur, L. H. Baekelend, C. O. Mailloux, E. J. Berg, Philip Torchio, R. P. Moses, W. L. R. Emmet and M. Namba.

Referring to this paper, Mr. Sperry pointed out that Emmet's discussion showed that the actual costs of generating steam by means of the turbine were as low as $16.10 per horse-power-year. This is equivalent to the conversion of 14.2 per cent of the energy of the coal into kilowatt-hours. He thought that the figures given by Professor Lucke were too high.

H. J. Parker presented a paper entitled "The Helion Lamp." This described the lamp which has been developed by Professor Parker and W. G. Clark. The idea in developing this lamp was to obtain a filament which could be run at a high temperature. As has been pointed out, the temperature which may be safely reached depends upon the vapor tension of the filament material. Silicon has the lowest vapor tension of any material, and is therefore the most suitable, but, unfortunately, its fusing temperature is low. Their work with this material, however, led them to the belief that they had found an allotropic form of silicon which had a much higher fusing temperature. The material is deposited on a carbon base filament. The characteristics of this filament were described at some length, and it was said that the efficiency now available is one watt per candle for a forty-candle-power unit. One-hundred-and-ten-volt lamps have but a single loop; 220 volts, but a double loop. Mr. Clark described briefly the characteristics of the Helion filament, calling particular attention to the fact that as the temperature increases a point is eventually reached where the candle-power seems to be independent of the current.

Replying to a question, Mr. Clark said that lamps which had been obtained had been run for 1,270 hours with a decrease in candle-power of only three per cent.

W. J. Hammer described briefly some interesting experiments which he had been making to determine "The Surface Properties of Aluminum and Zinc."

A paper by H. M. Goodwin and R. D. Mailey, on "The Intensity of Electrical Conductivity and the Viscosity of Certain Fused Salts and Their Mixtures," was read in abstract by S. S. Sadtler. The object of this was to determine the effect of temperature on the electrical conductivity of various salts.

The following papers were read by title: "The Titanium Arc," by R. Fleming; "The Present Status of the Thermodynamic Scale," by E. Buckingham.

The meeting was then adjourned.

The social features of the meeting were rather full, and kept the visitors busy for the three days of the meeting. On Thursday afternoon the laboratories of the University of Pennsylvania were inspected, and a visit paid to the plant of the United Water Improvement Company to see the commercial production of ozone for water purification. From there a visit was made to the plant of John F. Lewis & Brothers Company. In the evening a theatre party was given.

On Friday afternoon the members were given a trip on the Delaware River on the city fireboat Ashbridge, and visited the Disston Saw Works, where a Colby induction furnace was shown in operation. From there the party went to the Welsbach Company's factory at Gloucester, and in the evening attended an informal shad dinner at Washington Park.

On Saturday afternoon a visit was paid to the United States Mint.

A number of exhibitors showed apparatus of interest to the society, among these being the Leeds & Northrup Company and Eimer & Amend.

Dinner to Frederick P. Fish.

Charles F. Cutler, president of the New York Telephone Company, and Theodore N. Vail, the new president of the American Telephone and Telegraph Company, gave a dinner Tuesday evening, May 7, at the Metropolitan Club in honor of Frederick P. Fish, lately president of the American Telephone and Telegraph Company. The diners were the business associates of Mr. Fish, who gathered to do him honor on the eve of his departure for Europe on a vacation trip. Mr. Fish is to continue with the company as counsel. Among those at the dinner were: George F. Baker, Alexander Cochrane, Charles A. Coffin, William N. Cohen, T. Jefferson Coolidge, Jr., W. Murray Crane, Zenas Crane, Edward J. Hall, Morris F. Tyler, William D. Sargent, Alexander Cameron, Henry S. Howe, George V. Leverett, Henry D. Lyman, John G. Milburn, Charles Neave, Sylvanus L. Schoonmaker, Charles Steele, John I. Waterbury, Levi C. Weir, Robert Winsor and Enos M. Barton.

Second-Hand Edison Lamp Ruling.

A permanent injunction has been issued by the United States Circuit Court, District of New Jersey, restraining William F. McKeon and Joseph Conning, of Newark, N. J., from selling second-hand incandescent lamps unless marked "Used and Second-Hand." The decision, signed by Judge Gross, ends a litigation between the General Electric Company and the defendants which has extended over a period of three years.

Similar suits were instituted, one against Edward Mills, proprietor of the Newark Electrical Supply Company, and the other against Frederick F. Chase, proprietor of the Lamp Supply Company of New York. Neither of these parties defended, and decrees were therefore taken against them by default.

Opening of Illinois Traction System.

The first section of the alternating-current system of the Illinois Traction System was opened between Peoria and Bloomington on April 21. On that date a regular schedule was put into operation, cars leaving the terminal stations on the odd hour throughout the day from 5 A. M. to 11 P. M. Beyond the usual delays incident to warming up new equipment, the single-phase motors and auxiliary apparatus worked well. This road is one of four single-phase lines in the Middle West which have adopted single-phase alternating-current apparatus made by the General Electric Company.

Advance in Prices of Engines and Engine Supplies.

Owing to the continued advance in price for raw materials, particularly pig iron, and the evidence at hand that higher prices will prevail for some time, manufacturers of all kinds and descriptions of engines either have or are preparing to make a sharp advance in prices to cover the increased cost of manufacture and materials.

Bion J. Arnold Meets with Peculiar Accident.

Bion J. Arnold, the well-known engineer and past-president of the American Institute of Electrical Engineers, met with a most peculiar and painful accident in Chicago Tuesday of last week. He was trying out a new automobile with his brother and got down to crank the engine. The starting-bar was too far forward, and when the engine kicked Mr. Arnold's chin was forced down on the radiator and his teeth were driven through his tongue. At a hospital the injured tongue was sewed together, and it is now reported that Mr. Arnold is doing well and hopes to soon be able to talk again.

Electric Power Plant for the Collieries of Durham, England.

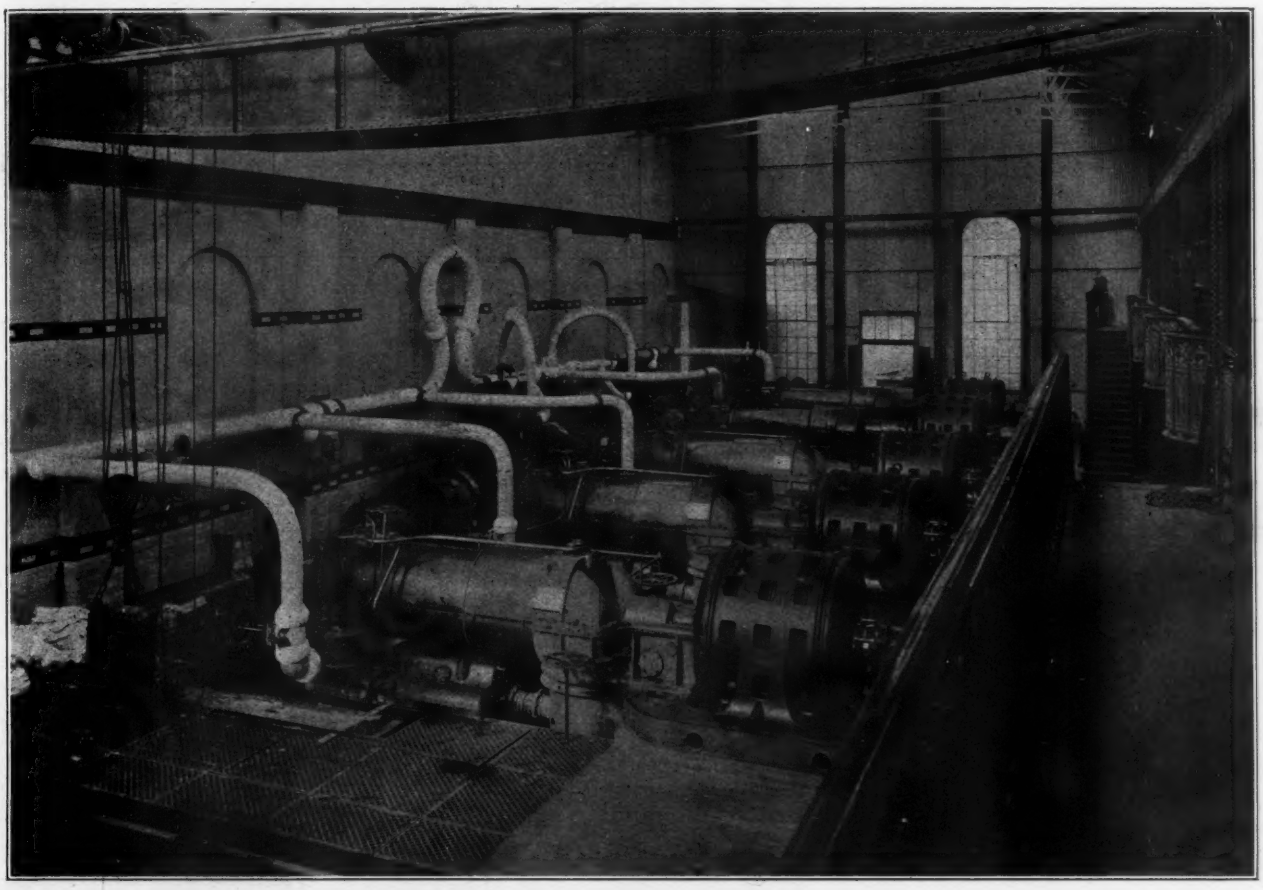
By A. H. Bridge.

THERE have already appeared in the pages of the ELECTRICAL REVIEW details of a number of the big power supply undertakings operating in the industrial and mining areas of the United Kingdom. A description is now given of the works and system which have been furnishing a supply of electrical energy to some of the groups of mines in the Durham district for about eight or nine months; *i. e.*, the works of the Durham Collieries Electric Power Supply Company, Limited, of which views are given in the accompanying illustrations, and also of the Lambton collieries installation, which takes power from the company. Both the Durham collieries power station and the Lambton collieries installation were put into operation last summer and have been in regular service since.

The generating station is located close to the village of Philadelphia, and is on the North Eastern Railway, with direct rail facilities provided to the private line of the Lambton collieries. There is a scarcity of water in the neighborhood, so a pipe-line had to be run to the river two miles away, and a motor-driven pumping station, electrically controlled from the power station, has been installed by the waterside. Here two eighty brake horse-power totally enclosed Peebles induction motors are installed, driving Gwynne centrifugal pumps; either set being large enough to supply water for the station under full load. The water is pumped to a large storage reservoir, distinct from the cooling pond, and the make-up water for the cooling pond is supplied from this reservoir.

The equipment of the boiler house includes five large Babcock & Wilcox water-tube boilers, fired by Erith's underfeed stokers. A simple arrangement has been adopted for the steam piping. A main header is fitted with valves between each pair of turbines, and the steam pipes are led off to the boilers and turbines, respectively, through T-connections, so that any one boiler and turbine may be run as an independent unit if desired, or a damaged length of piping cut out.

There are five turbines, three of which were made by C. A. Parsons, and two by Willans & Robinson. All of them are identical in principle, differing only in constructional details, and they were all made for Bruce Peebles & Company, of Edinburgh, who were the main contractors for the station, and to whom the writer desires to express his indebtedness for material assistance in connection with the present article. Each of the turbines runs at 1,500 revolutions per minute, and is direct-coupled to a Peebles 1,550-kilovolt-ampere turbo-alternator which generates



POWER STATION, DURHAM COLLIERIES, SHOWING FIVE 1,550 KILOVOLT AMPERE TURBO-GENERATORS. THREE PEEBLES-PARSONS IN FOREGROUND, AND TWO PEEBLES-WILLANS IN BACKGROUND.

three-phase current at 6,600 volts, fifty cycles, for distribution mainly by overhead transmission lines to various neighboring pits. From this same power station a supply is given to the Sunderland district tramways through the medium of a substation arranged in the corner of the generating station, and equipped with two 500-kilowatt Peebles-La Cour motor converters which convert the high-tension alternating current to continuous current at 500 volts for running the tramways.

The overhead high-tension transmission line from the station to the Lambton collieries consists at first of four three-phase circuits, *i. e.*, twelve wires in all, carried on "H" pole construction. Here and there single lines branch off to transformer substations at the various pit-heads.

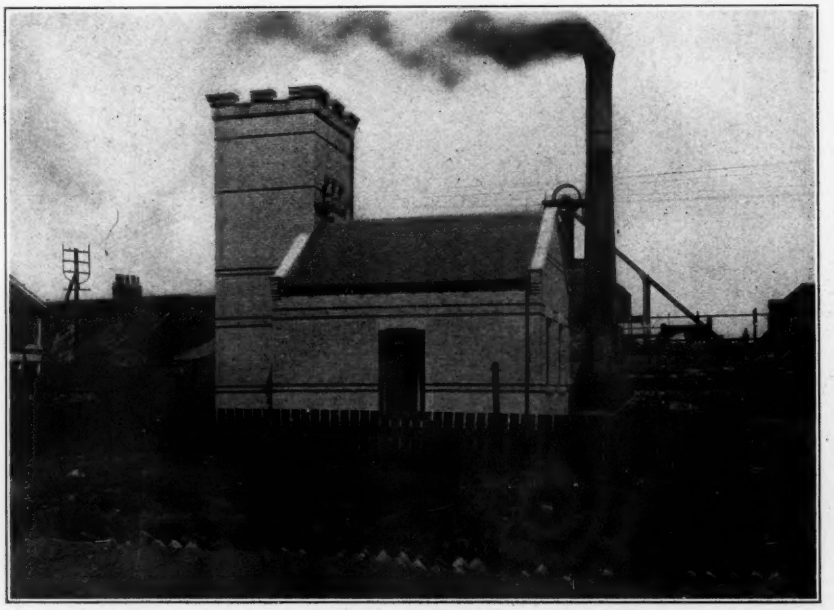
A stretch of single-pole construction

Babcock & Wilcox Boilers and Erith's Underfeed Stokers, Durham Collieries.

which is fairly typical of most parts of the line, except, of course, that the number of circuits varies from one to four, is shown in one of the illustrations. Where more than two circuits are to be carried, double-pole construction is employed. The poles are from thirty-six to forty-eight feet in length sunk from six to eight feet in the ground, according to length. At six feet from the ground their diameter is nine inches, tapering to seven inches at the top. The minimum height of the transmission lines at the ground level is twenty-one feet, and the maximum thirty-six feet. The latter occurs at the point where the transmission line crosses over the Sunderland district trolley tramways. The transmission lines are enclosed throughout in a strong guard net which is supported by heavy harp-shaped iron brackets mounted on the poles. The longitudinal wires of the guard nets are No. 8 galvanized steel, and the locket wire is No. 14 iron. The guard net is earthed at both ends, and at frequent points throughout its length, so that if a transmission line should break, it would be earthed immediately and be rendered harmless. Spirals of barbed wire are wound round the poles to prevent unauthorized persons from climbing.

For the transmission to Lambton collieries the main line is in three sections, special terminal poles being provided at the end of each, so that the line may be disconnected at these points if necessary. Near each pit there is a substation which contains high and low-tension switches, lightning arresters, transformers, etc. In some cases, however, the current is taken down the pit direct at 6,500 volts, undergoing no transformation above ground. The substation, in such cases, simply forms a distribution station, controlling the various cables running down the pits, though it is generally equipped also with a small transformer for lighting supply in the neighborhood.

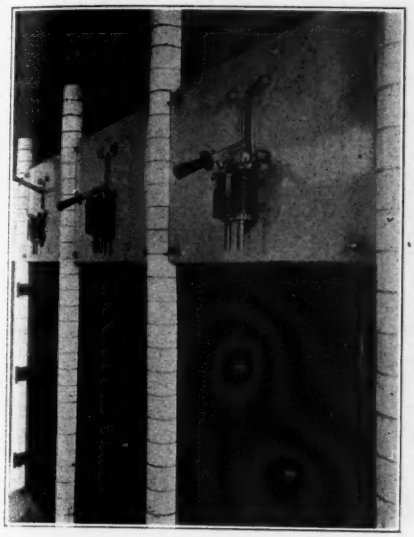
Desk Type Switchboard, Power Station, Durham Collieries.



Substation at "D" Pit Lambton Collieries.

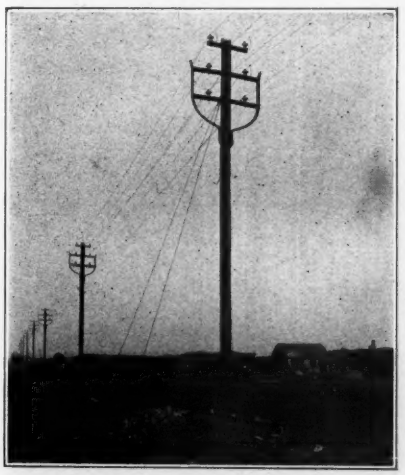
As one of the accompanying illustrations shows, the high-tension leads enter the tower through circular holes in heavy panes of glass, and the strain is taken up on shackle insulators just inside the tower.

The leads are then turned downwards and connected to the horn-type lightning arresters with carbon resistance and choke-coil. They are then connected up to the high-tension bus-bars, which are carried on heavy insulators above the switch-panels, and from these buses connections



Substation High-Tension Panels.

are carried to the main oil switches in the fireproof compartments beneath, and thence to the high-tension side of the transformer. In some cases, however, outgoing high-tension feeders, either overhead or underground, have to be connected up to the high-tension bus-bars, and in such cases an oil switch is provided on the outgoing feeder, together with the



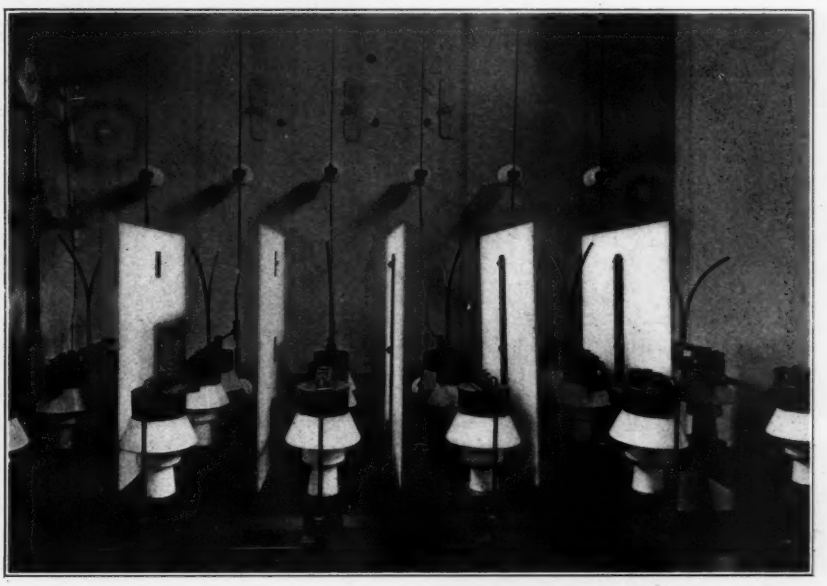
Transmission Line from Power Station to Lambton Collieries.

necessary disconnecting link switch. When the outgoing feeder is overhead, lightning arresters of the Horn type are provided.

The low-tension side of the substation follows standard practice, oil switches with overload release being fitted to each feeder, together with the necessary instruments.

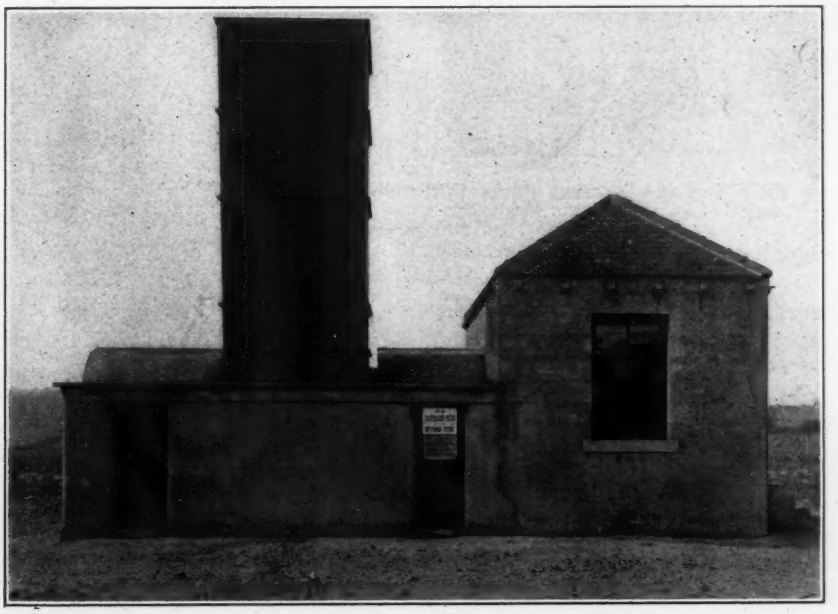
The cables down the shafts and in the workings were supplied by various makers, but they are mostly of the lead-covered type with double wire armored cores, paper insulated and fixed in the shaft by means of long wooden cleats, bolted to channel irons let into the walls. In the case of the workings they are suspended from the props by means of wooden hold-fasts or by tarred-rope slings, which will break and allow the cable to drop uninjured in case of a fall of roof.

There are several substations underground as well as those on the surface.



Lightning Arresters in Substation.

For example, at the "D" pit three high-tension cables and one low-tension cable are carried underground direct from the surface substation, the high-tension cables running to four substations in the workings. Three of these substations also form compressor houses, Ingersoll air-compressors being driven in each case by a Peebles 150-horse-power enclosed, ventilated, induction motor with metallic controllers specially adapted for this work. The fourth substation is located 1,700 yards "inbye," and furnishes a supply to various small motors for pumping, coal-cutting, local lighting, and other purposes. Each substation has an oil-cooled trans-

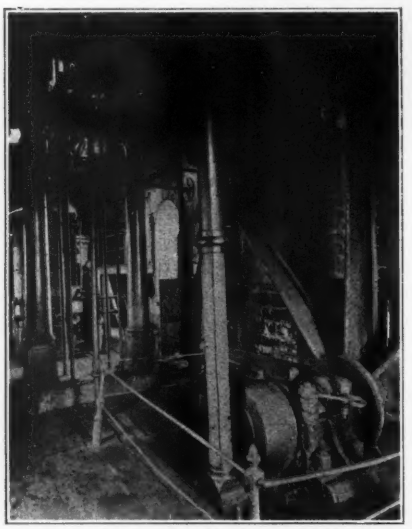


Fan House, with 150-Horse-Power Motor-Driven Fan.

former, reducing the primary pressure from 6,500 volts to 500 volts for working. The oil-break type of switch gear is installed which complies with the special Home Office Regulations issued a year or two ago governing the use of electricity in mines.

In addition to the compressors, the underground substations also supply in "D" pit a ten-horse-power Peebles machine driving a small haulage for handling empty tubs; and four seven and a half horse-power plunger pumps which are driven by Peebles motors of a special design fitted with automatic starting mechanism so that they can be started against full-load by simply closing a switch.

In the surface substation there is a fifty-kilowatt transformer for supplying lighting current to the engine planes,



Old Beam Pumping Engine (Built 1852) Superseded by Turbine Pump.

roads, stables, etc. It gives a secondary voltage of 380 volts between phases, or approximately 220 to neutral.

At the "Lady Ann" pit there is a surface substation which contains two 175-kilowatt transformers in addition to the necessary high and low-tension switch gear, etc., and current is carried down this pit partly at high and partly at low tension, there being one high-tension and one low-tension cable. The latter is of 0.5 square-inch section, and carries 500-volt current to a special disconnecting Y box in the "five quarter" seam. From this dividing box one cable runs further down the shaft to the "Brass Thill" seam and the other supplies a main and subsidiary haulage engine in the "five quarter" seam. The main haulage is driven through double-reduction cut gearing by a 100-brake horse-power three-phase Peebles motor, which has an overload capacity equivalent to 200-brake horse-power for short periods. The drums of the gear are five feet in diameter and the rope speed is normally eight miles per hour. There is a special haulage controller of the liquid type, of massive construction and adapted to rough and ready service. By its aid it is possible to run the haulage at any speed from creeping upwards, and for any length of time. The possibility of using this controller at creeping speed is thus most useful in cases where tubs have run off the rails and must be hauled back to them, though the probability of tubs running off, and also the amount of coal shaken off the tubs during the haul, are very much reduced by the steadiness of electric haulage fitted with the controller mentioned above. It is the duty of the main haulage gear to haul fifty to sixty tubs per journey, weighing fifteen hundredweight per tubful, and five hundredweight empty, up a road 1,500 feet in length, and having an average gradient of one in sixteen, and a maximum of one in nine. The auxiliary haulage serves to pull the empty tubs up a slight gradient to the main haulage, and is driven by a ten brake-horse-power

Haulage (Lady Ann Pit) Driven by 100-Horse-Power Induction Motor, with Liquid Controller.

175-Horse-Power Induction Motor Driving Turbine Pump in Brass Thill Seam, Lady Ann Pit.

Peebles squirrel-cage motor. It has a single drum two feet in diameter, and the rope speed is one and a half to two miles per hour.

The second cable from the Y box in the "Lady Ann" pit supplies principally a 175-brake horse-power high-speed motor-driven turbine pump in the "Brass Thill" seam. This pump is direct-driven at 1,440 revolutions per minute by a totally enclosed motor of the slip-ring type, and lifts about 700 gallons per minute against 612 feet. This turbine pump replaces a ponderous old shaft pump of the spear-rod type driven by a vertical beam engine, the cost of running which is reported to have been over $15,000 a year.

The Lumley pit has at bank a substation containing a 250-kilowatt transformer and one high and one low-tension cables are run underground. The high-tension cable feeds a 100-kilowatt transformer about 1,100 yards "inbye," and low-tension cables run from here to the face, a distance at present of about 500 yards, to supply coal-cutters. A cable is also run to a 100-horse-power motor which drives a haulage similar to that at the "Lady Ann" pit. In the "Brass Thill" seam a low-tension cable runs about 2,250 yards "inbye" to gate-end boxes from which coal-cutters draw their supply by trailing cables.

One of the most interesting motor applications of the whole installation is located 170 yards from the Lumley surface substation and fed by low-tension cable. This is a fifty-five-inch double inlet Sirocco fan driven by a two-speed motor (Peebles) of 62.5 or 125-brake horse-power running at 183 or 365 revolutions per minute as required. The fan has a capacity of 145,000 cubic feet per minute against a water-gauge of two and a half inches, and serves to ventilate the "five quarter," "low main" and "Brass Thill" seams.

In addition to the foregoing, there are a number of continuous-current motors driving haulages, coal-cutters, pumps, etc., in the "Margaret" pit. These motors are supplied from small auxiliary dynamos in the Durham collieries' power station. From the "Margaret" surface substation one high and one low-tension cables are carried down the pit. The high-tension cable will eventually supply a transformer in the "Deep Hutton" seam, for several large motor-driven pumps now in process of installation. The low-tension cable is for lighting only, and feeds a twenty-kilowatt, 500-110-volt transformer for this purpose.

It is with the permission of A. Kirkup, the agent for the Lambton collieries, who was closely concerned in the work of electrification from first to last, that the above information regarding this most important of recent colliery installations is given. It should also be added that Maurice Georgi acted throughout as consulting engineer on behalf of the Lambton collieries.

The Fourteenth Annual Meeting of the Bunsen Gesellschaft.

The 1907 meeting of the German Society of Electrochemists, now known as the Bunsen Gesellschaft, is to be held at Hamburg, Germany, from May 9 to May 12, under the presidency of Professor Walther Nernst, of Berlin.

The formal reception of members attending this year's meeting of the society will take place in the upper assembly room of the "Geholung" on the Holstenplatze, on the evening of May 9.

On Friday, May 10, the first business meeting of the members will be held in the hall of the Oberrealschute. Addresses of welcome from the president and town authorities will be delivered, and after presentation of the annual report, the following papers will be read and discussed:

A.—LECTURES UPON RADIOACTIVITY AND THE THEORY OF ATOMIC DISSOCIATION.

1. Professor Bollen (Hamburg). General introduction to radioactive phenomena.

2. Professor Merckkwald (Berlin). "The Chemical Properties of Radioactive Substances."

3. Professor Meyer (Freiburg). "The Production of Helium from Radioactive Elements."

4. Dr. von Lerch (Vienna). "The Nature of the Emanations from Radioactive Substances."

5. Dr. Hahn (Berlin). "The Theory of the Dissociation of the Atom."

6. Dr. M. Levin (Göttingen). "Deductions from the Theory of Atomic Dissociation."

7. Professor Henrich (Erlangen). "The Radioactivity of the Air and of Water from Mineral Springs."

A general discussion upon radioactivity will follow the reading of these papers.

B.—PAPERS UPON INDEPENDENT SUBJECTS.

1. Professor Luther (Leipzig). "Electrolytic Aktiviering Phenomena."

2. Professor Abegg (Breslau). "A Chemical Method for Determining Differences of Potential."

3. Dr. Riesenfeld (Freiburg). "Indirect Oxidation and Reduction."

4. Professor Nernst (Berlin). "The Dissociation of Ammonia."

5. Professor Bose (Olivia). "The Kinetics of Radioactivity."

6. Professor Brauner (Prague). "Notes Upon the Atomic Weights."

7. Professor Haber (Karlsruhe). "A Gas-Refractometer."

8. Professor Loeb (Berlin). "The Chemical Theory of Alcoholic Fermentation."

For Saturday, May 11, no fewer than sixteen papers have been planned for reading and discussion.

1. Dr. Arndt (Charlottenburg). "Notes upon the Electrolysis of Fused Salts."

2. Professor Cohen (Utrecht). "Notes upon Explosive Platinum."

3. Dr. Gardes (Erlangen). "Notes upon Silicites and upon the Chemistry of Colloids."

4. Dr. Berckhold (Frankfort). "Investigation of Colloids by the Filtration Methods."

5. Dr. Herzog (Karlsruhe). "The Diffusion of Colloids."

6. Professor Coehn (Göttingen). "Photochemical Reactions."

7. Dr. Frantz (Freiburg). "Photochemical Investigations."

8. Dr. Bernonilli (Aachen). "A Rekursion Formula for the Atomic Weights."

9. Dr. Loebe (Berlin). "The Use of Micrographic Methods for the Study of the Phase Law in Solids."

10. Professor Foerster (Dresden). "The Influence of Temperature upon the Electrolytic Deposition of Metals."

11. Professor Henri (Paris). "Experimental Investigations of Immunochemie."

12. Andre Mayer (Paris). "Formation and Characteristics of Complex Organic Colloids."

13. H. Iscovesco (Paris). "Analysis of the Colloidal Components of Living Organisms."

14. Emil Abel (Vienna). "Notes upon Catalytic Intermediate Reactions."

15. Professor Brauner (Prague). "Contributions to the Study of the Rare Earths."

16. Professor Cohen (Utrecht). "Contributions to the Historical Study of Laughing Gas (Nitrous Oxide)."

The social festivities include the annual dinner on the evening of Saturday, an evening entertainment by the Hamburg Teachers' Association, and a sea excursion upon Sunday on the Hamburg-American Company's liner Deutschland.

The Telephone Wire Plant.

At the 218th meeting of the American Institute of Electrical Engineers, Sergius P. Grace, chief engineer of the Central District and Printing Telegraph Company, Pittsburg, Pa., presented a paper entitled, "The Telephone Wire Plant." The meeting was presided over by J. J. Carty, chief engineer of the New York Telephone Company. An abstract of the paper and the discussion follows:

An analysis of the construction costs of the telephone plant will show that from two-thirds to three-fourths of the total expenditure is required for the outside plant; that is, for conduits, poles, cables and wire.

In considering a telephone plant for a community, the first thing to be done is to decide upon a proper development plan for the growth of the business for a reasonable number of years. In view of the rapid advances in the telephone art and the possibilities of the introduction of new systems of transportation and communication, it would seem that fifteen to twenty years is as far ahead as we are justified in planning telephone development. A careful estimate must also be made of the ratio of lines to stations. Thus if a very high party-line development is expected, the ratio of lines to stations will be low. To-day the telephone line really means more to us from the wire plant standpoint than the number of telephones. Formerly we used to consider the number of telephones as affecting the wire plant; now it is the number of lines.

In small cities where the number of telephone lines in the ultimate will not exceed 8,000 to 10,000, it is reasonably certain to assume that one exchange will prove the most economical. If one exchange is decided upon, a location for this exchange must be determined which will make the subscribers' line wire mileage a minimum. The determination of this centre with extreme precision is a problem for the calculus. The most simple case is when the streets are all rectangular, in which case the mathematical centre of distribution is found by drawing lines at right angles through the exchange area, so that the number of telephones in the ultimate on each side of the lines is the same. If the present centre is a considerable distance from the ultimate centre, a mean centre between the two should be decided upon.

When the centre is determined, a complete conduit system should be laid out, touching at least one side of every block in the exchange area. It will never be necessary to construct all this conduit at once, and perhaps even in the ultimate much of it will not be installed, but if a definite plan is prepared the conduit extensions from time to time will be of correct dimensions and in the right direction. This conduit must, of course, feed to the exchange centre by the most direct routes possible, and the lines should be concentrated in the smallest number of subways which will not affect the efficiency of the distributing system.

In the case of a large city where it is evident that a number of offices will be required to furnish the service, it is a very complex and complicated problem to determine how many exchange districts there should be. The cheapest number of districts will vary as follows:

1. With the grade of talking transmission.

2. With the subscribers' mileage—varies directly as the number of offices.

3. With the A and B position equipment—varies directly as the number of switchboards.

4. With the multiple jacks—varies inversely as the number of switchboards.

5. With the rent—varies directly as the number of offices.

6. With the office constant—varies directly as the number of offices. This office constant takes care of the equipment which is common to all offices, such as the charging dynamos, storage batteries and power-boards.

7. With the central office labor—varies directly as the number of offices.

8. With the trunk mileage—varies directly as the number of offices; also on number of calls per line and per cent of trunking.

Good telephone service is fundamentally based upon good talking efficiency. The means for transmitting the talk is what the telephone company really furnishes to the subscriber. In very large city districts, because of the distances between the central offices, the cost per message is materially increased on account of the high-grade trunk plant required to give the subscribers good transmission. The central battery system of subscribers' lines has proved very efficient and economical from service and maintenance standpoints. There is, however, a considerable loss introduced into each line by the ohmic resistance which operates to cut down the flow of current through the transmitter. In addition, then, to the attenuation loss present in all cases we have added to this in the transmitting loop a loss due to the reduction of the current through the transmitter.

In designing the subscribers' lines, twenty-two-gauge cable should be used as much as possible. In the case of a large city with a number of central offices there is a limiting resistance for the subscribers' lines which can not be exceeded without making the trunking plant very expensive. This limiting resistance of the subscribers' line will vary in different cities because of the varying distances between central offices which affects the trunk line mileage.

To lay out a city in the correct number of districts all the items above mentioned must be given careful consideration. From past experience it is generally possible to predict approximately the number of districts which will be found most economical. A number of districts above and below this value should be decided upon, and the costs and annual charges for each of these three groupings should be carefully calculated. The first cost and annual charges of all the variables given on preceding pages must be known in order to make these comparisons. Our past experience indicates that the following is about the best theoretical number of districts for cities of various sizes:

	Offices.
For an ultimate of 10,000 lines or less	1
For 10,000 to 15,000 lines	2-4
For 15,000 to 25,000 lines	5-8
For 25,000 to 35,000 lines	6-10
For 35,000 to 50,000 lines	8-12
For 50,000 to 100,000 lines	10-16

After the number of offices has been decided upon, and the conduit study following the general development plan is made, it yet remains to construct the outside plant so as efficiently and economically to connect the subscribers by means of the wire plant to the central offices. Conduits should be built in the congested districts and along what may be considered as main feeder routes. In general it is economical to construct at once a conduit if 400 to 800 pairs of wires are expected within five years. In the vicinity of the underground conduit system every effort should be made to connect the subscribers without resorting to aerial construction. Where the buildings are large and permanent and an average of ten telephones per building may be expected, the best method of construction is a cable directly into each building from the nearest manhole in the main conduit system. In the case of large office buildings one or more building cables should be run vertically in the wire or pipe shafts and terminal boxes provided at each floor, to which can be connected the individual wires for each telephone. The scheme for distributing these individual wires most to be preferred is the hall molding scheme. These hall molding

troughs should connect to the terminal box on each floor so that the wires to each telephone may be run from time to time as needed. This system is cheaper to install and easier to maintain than the conduit system following electric light practice. In many cities there are large areaways under the sidewalks, and a cable run through these areaways from one building to another and provided with a tapping terminal on each property makes a very good form of distribution.

Where the blocks in the vicinity of underground conduit are well built up, but where none of the buildings is large enough or important enough to warrant direct connection, the interior block system may be used to great advantage. In this system one or more underground laterals from the main subway system are run into the interior of the block and terminated on the rear walls of the most substantial buildings. Around the interior walls at a height preferably not over ten feet from the ground are cleated lead-covered dry-core cables. At intervals of 100 to 200 feet a multiple tap is taken to terminal boxes. From these terminal boxes No. 18 B. & S. gauge rubber-covered and braided bridling wire is carried through bridling rings spaced about four feet apart to the various entrances to the subscribers' premises. This distributing cable is, of course, connected to an underground cable from the main subway.

Distributing poles are useful for furnishing connection between the underground system and the subscribers' premises during a period when direct connection or interior block wiring is not warranted. Ultimately, it seems certain that the distributing pole is bound to go.

In the territory about Pittsburg the topography of the ground is exceedingly rough. This results in winding streets and almost an entire absence of alleys. To construct very large open wire lines in these winding streets was early seen to be impracticable, and when the great expansion of the telephone business began in 1897 it became imperative to design other methods for aerially distributing telephone lines. The system which was finally worked out and decided upon is that known as the aerial cable or all-cable system which was adopted in 1897 and has been our standard type of aerial construction ever since. In this system, very low poles are used, rarely exceeding thirty to thirty-five feet in height. These distributing lines are placed in alleys if they are available. A cable is strung near the tops of the poles, and on alternate poles are placed ten or fifteen-pair terminals. Each pair in the distributing cable appears in from two to four terminals, and common pairs are so laid out in adjacent terminals that it is easy to provide for party lines. The multiplying is so arranged that when the cable becomes crowded it may be cut into two or four parts, all pairs appearing in each part, and relieved by feeder cables. No cross-arms or bare wires are used for distribution along the lead, but from the binding-posts in the cable terminal a twisted pair, rubber-covered, and braided wire is strung directly to a point within the subscriber's premises. The use of this well-insulated twisted pair wire very materially reduces the maintenance. An aerial cable system of this kind with twisted pair wires leading directly to the subscribers' houses is undoubtedly the most sightly form of aerial distribution, since all the cumbersome and troublesome open wires are done away with.

There has been considerable discussion among engineers regarding the life of twisted-pair, rubber-covered distributing wire. Rubber and paint are somewhat alike, in that all kinds of mixtures are sold under their names. From the very beginning we have been careful to specify a reasonably high grade of rubber and to insist on making tests of all wire submitted to us, to be sure that our specifications have been complied with. Very good wire was thus obtained, and samples which we now take down after having been in use for seven to nine years still show an insulation resistance of 200 to 400 megohms per mile when submerged in water. If the ordinary type of market wire, which is mainly intended for inside wiring, is used, the life will be much shorter. A good quality of rubber distributing wire well protected with a heavy braid should prove serviceable for ten or fifteen years.

Until recently the type of distributing wire most generally used was made of No. 14 B. & S. gauge copper. This size of wire was not necessary for conductivity, for as a rule it was connected to a twenty-two or nineteen-gauge cable pair. This size of wire was required for mechanical strength, because the wire was strung in spans and had to be self-supporting. During the past year there has been put on the market a copper-clad steel wire which is made by a new method. Copper is welded to a steel ingot and the copper and steel drawn out uniformly together. From all the examinations we have been able to make it seems that there is a perfect union between the copper and the steel. A No. 17 B. & S. gauge copper-clad wire having thirty per cent conductivity of copper has the same tensile strength as a No. 14 B. & S. hard-drawn copper wire. This reduces the amount of material in the distributing wire one-half, and what is still more important, on account of the reduced area, decreases the amount of expensive rubber compound required to surround the wire. The amount of braided covering is also materially reduced. The finished wire is very light and easy to handle and costs approximately thirty per cent less than the No. 14 B. & S. type of wire.

There will, of course, be many streets and districts where for the present time aerial cable is not warranted. If these districts are in the neighborhood of an aerial cable base line, and the subscribers are not located more than 1,000 feet away from the cable line, it is economy to connect them with twisted pair wire strung on distributing brackets rather than to resort to the use of bare wire and cross-arms, where perhaps a large part of the arm capacity will lie idle for several years. If the side streets are clear of trees and it appears probable that many of the circuits will be more than 1,000 feet long, the distribution should be made by means of bare wire on cross-arms. Generally speaking, the bare wire on these side lines should be of copper, for at the present time with so much sulphurous smoke in the atmosphere of our cities and towns, the life of iron wire is too short to give the wire serious consideration. Copper wire smaller than No. 14 N. B. S. or No. 12 B. & S. gauge can not safely be used in spans because of its low tensile strength. This size of wire is not required for conductivity, since in the places where this wire is usually strung we would be satisfied with a cable conductor of nineteen or twenty-two gauge. Here again it also seems possible to make considerable saving by the use of copper-clad steel wire. A No. 14 B. & S. or No. 16 N. B. S. copper-clad wire is sufficiently strong mechanically and has a conductivity equivalent to a nineteen-gauge cable pair. This will reduce the first cost of line wire about one-half.

In opening the discussion, J. J. Carty spoke, in part, as follows:

"The paper does well to call attention to the great magnitude of the telephone wire plant as compared to the switchboard plant. The switchboard apparatus, all being assembled at the central office, can readily be viewed as a whole, and presents

a very commanding appearance. The switchboard has too long held the centre of the stage, and it is high time that attention be directed to some of the numerous other features, aside from the switchboard, which are necessary for a complete telephone system.

"The telephone wire plant of the city of New York and suburban territory tributary to it consists in round numbers of one million miles of copper wire. Most of this copper wire is enclosed in lead-covered cables. The superficial area of the lead pipes covering one of these cables amounts to 7.6 acres. The superficial area of the lead pipes covering all of the cables in this system of one million miles of wire amounts to one hundred and ninety acres. All of this lead pipe is needed to protect from water and moisture the delicate paper-covered wires within, and a puncture in one of these pipes no larger than a pinhole will admit moisture and sooner or later cause a fault, producing an interruption of the service of one or of all the circuits within the cable.

"In the first telephone installations the wires, as a rule, were overhead and composed of iron, following the standard telegraph practice of the time. Soon it became necessary to extend telephone wires across rivers, and here for the first time telephone cables were used, the guttapercha or rubber-covered cables employed by the telegraph companies being imported into the telephone service for the purpose. As the number of wires increased, rubber-covered wires in cables were used to run upon poles and house tops.

"Some use was also made of overhead cables composed of cotton saturated with beeswax and protected with rubber tape and braid. As might be expected in the light of our present knowledge, these cotton and beeswax cables failed. This failure, taken together with the bad experience obtained with paraffin-covered cotton office wires, led to the conclusion that cotton was a bad insulator, and for some time, where cables were employed, rubber was the material used.

"Owing to the high specific inductive capacity of rubber, the transmission obtained through rubber cables was extremely defective and the cross-talk was almost intolerable.

"Experiments were also made with rubber-covered wires at an early date, laid in underground ducts. These were unprotected by lead pipe, and besides being open to the before-mentioned objections to the use of rubber cable, were especially subject to decay in many places underground.

"All of these experiences led to a search for something better than rubber. Foremost among those who worked upon this subject was William R. Patterson, of the Western Electric Company, whose scientific investigations and remarkable practical skill brought forth a cable consisting of cotton and paraffin, in this respect resembling very much the cotton and beeswax cable which had been the cause of so much disastrous experience. It was a difficult thing to convince any one that cotton and wax could be a good insulator, but it was shown that perfectly dry cotton was an excellent insulator, and that the former failures were due to the fact that, owing to its hygroscopic nature, cotton had absorbed moisture from the atmosphere and in the process of manufacture, and thus had its insulation destroyed. It was demonstrated that if the cotton core of the cable were thoroughly dried in an oven and then quickly hauled into a lead pipe and sealed up at the ends, that insulation as high as one thousand megohms or more per mile might be obtained, and that this high insulation would persist as long as moisture were kept from the core. The introduction of such a cable involved an entirely new state of the art and required that all those engaged in telephone construction should reform their ideas in the light of the new knowledge. After much agitation and discussion and after a rigorous campaign of education, the superiority of the fibre cable, properly made and installed and maintained, was demonstrated, and from that time the use of rubber cable began to decrease.

"After much experience, it was found that the filling of wax might be omitted from the cable and yet the moisture could be kept out. This resulted in dry-core cotton cable which had the advantage of much lower capacity than the filled cable, and was not so much affected by heat as was the cable containing wax.

"The underground telephone cable of to-day is composed of copper wires covered with paper, all enclosed in hermetically sealed lead pipe. This type of cable has persisted so long and seems to answer its purpose so well, that telephone engineers as a rule are fairly well content with it, and are no longer agitated by those serious questions which I have just discussed.

"The tendency in cable construction and in telephone line construction generally has been to drive rubber insulation out of the field which it formerly dominated. It is now restricted to distributing wires, inside wiring and certain special switchboard wiring. While the use of this rubber insulation has relatively decreased, in the absolute amounts used, there has been a tremendous increase in the mileage employed.

"The open wires used in the first telephone lines as a rule were made of iron and, as a rule, especially when employed in lines of any great length, they gave impaired service. The reasons for this are, of course, now well understood, but at the time of which I speak not much was known concerning the laws of transmission, or regarding the electrical and magnetic properties of iron, and there was a long period of groping in the dark. Where long-distance wires (at that time forty or fifty miles was long distance) were used, imperfect results were obtained, and in some cases it seemed that by using larger iron wires matters were made worse. During all of this period of fumbling and groping, there was one engineer with clear vision who perceived that if copper could be obtained with suitable mechanical qualities, it would be an excellent material for telephone lines. He directed his attention to this subject, and produced hard-drawn copper wire in suitable form for telephone lines. I refer to Thomas B. Doolittle, who was the first one to use hard-drawn copper wire as the material for telephone lines. Hard-drawn copper wire was thus used by him at an early date in Ansonia, Ct. The results obtained were satisfactory, and, after a number of years had elapsed, a practical demonstration of the value of hard-drawn copper wire for long-distance lines was made by stringing a circuit extending from Boston to New York. The success of this circuit, using hard-drawn copper wire, demonstrated the feasibility of long-distance telephony. Compound wires of various sorts have been suggested from time to time, but invariably they have been found unsatisfactory for long-distance transmission. Whatever use they have must be for local lines, and the precise function of this bi-metallic wire in such lines is yet to be generally agreed upon.

"While much has already been accomplished in the perfection of the telephone wire plant, much still remains to be done, and to make out record of future achievement as worthy as that which has already been accomplished, we must constantly direct our efforts not only along broad and comprehensive lines, but also we must pay strict regard to each and every one of the thousands of small pieces of apparatus, many of which are dealt with in the paper,

and all of which go to make up the sum total of the telephone wire plant."

Hammond Vinton Hayes, chief engineer of the American Telephone and Telegraph Company, then addressed the meeting. Mr. Hayes said:

"This question of making the development plant is an amusing one in a way in that it is really a kind of scientific guess. It is an attempt to make a forecast of what the future will be and to endeavor to see along as broad and as well-defined lines as possible where the future telephone will be and what the plan will be, and in doing that work we have found it very desirable in practice to employ a group of young men whose sole duty it is to go from place to place and study first one city and then another, and that in order to be able to correlate their experience in one place with that of another, to make the plans the best and most logical possible. We are up against an embarrassing situation always, because if we attempt to go the distance with local men, there is such enthusiasm in the growth of the town that there is a very great tendency to build the plant much larger than it should be. Under other circumstances there is the reverse. In fact, I am practically of the opinion that the judgment of some of them perhaps untrained might be as satisfactory in the long run; but what we do is to do the best we can along some such lines as Mr. Grace has outlined in making the most scientific guess that we can as to the future of our plant."

With regard to an all-cable plant, Mr. Hayes said:

"All the planning we are doing in every city and every town in the country is planning not only for the distribution of the wires to the substation, but also that the substation in each town will be capable of talking to every other substation in other towns. And this placing of cable lines in cables can not be applied to our long-distance circuits to any great extent, for the reason that the cables tend to cut down the efficiency of service, and what we must do is to get the wire plant of the system not only the best possible for maintenance reasons, but one which is capable of enabling us to talk over this wide range of material."

G. M. Yorke said: "The system described by Mr. Grace is mainly used for connecting the subscribers' stations with the nearest central office. But this portion of the plant is used for a large percentage of the time merely for communications between stations only a very few miles apart. Now, when we come to consider that other very important portion of the telephone plant used for connecting central offices together that are many miles apart—hundreds of miles apart—we see that such an extensive use of cable is absolutely impossible. The reason for that is that the cable circuit has always been very inefficient in transmitting speech. That inefficiency still exists in spite of the improvements in cable manufacture that have been touched upon and also in spite of general improvements in a general way. As an example of the inefficiency of cable circuits, we might take the type of circuit used for the longest distances in this country. These circuits are about fifty times as efficient as the form of cable circuit described by Mr. Grace and used for subscribers' lines so largely. In other words, one of the regular lines from New York to Chicago talks as well in volume and in quality as a cable circuit of the sort described by Mr. Grace only twenty miles long. The further point is that if we connect only ten miles of such cable to this long open-wire circuit, it is necessary, in order to keep the transmission efficiency at the same point of loudness and quality, to practically double the weight of copper in the long-line circuit. Of course, this is an extreme illustration. In view of this relative inefficiency of cable circuits we are not going to speak right away of an all-cable long-distance plant. It is necessary to bring the open wires as near to the centre of the terminal cities as is practicable and to keep all-cable out of intermediate cities if we can. That becomes more and more necessary in view of the increasing amount of cable that it is necessary to use in subscribers' lines. One of the barriers has been the navigable stream. Of course, some of them are crossed by cables; but in some cases high towers have been erected.

"I simply want to point out that the open wire is not going to go just because it is unsightly. We are going to keep it if we are going to keep long-distance telephone service."

F. L. Gilman, assistant chief engineer of the Western Electric Company, said there was only one point that he wanted to speak of in regard to the manufacturing side of the problem, and that was the lead-covered cable. As has been said and referred to several times, a considerable advance has been made in that way, and the present paper-insulated, lead-covered cable has been used for a considerable length of time and is proving very satisfactory. The great effort in recent years has been to get more wires and more conductors into a given amount of space without increasing the electrical characteristics of the cable which are harmful to the transmission, and without getting down to the size of the wire, that can not be handled easily. Mr. Gilman also emphasized the importance of the rubber braiding or rubber-covered twisted wire for outside runs.

Kempster B. Miller addressed the meeting briefly, as follows: "One tendency that is very evident from what has been said to-night is the gradually diminishing degree to which we find bare wire in local telephone plants, and I am speaking now of the local plant as distinguished from long-distance plants. There are some who have contended that there should be absolutely no bare wire in a telephone plant, and several plants of considerable magnitude have been constructed in which I understand there is not a foot of bare wire in the local plant. The practice that Mr. Grace has outlined stops just short of this extreme practice, and it seems to me that it stops in just the right place. To say that there shall be absolutely no bare wire in the plant simply for the purpose of being able to boast that there is no bare wire in the plant is in the nature, I think, of riding a hobby rather than in the nature of engineering practice.

"I think there is some danger, perhaps, after listening to the beauties of the paper cable as outlined by Mr. Carty, that people in other arts than telephony should be so carried away with it that they adopt it perhaps where it would be dangerous to do so. The paper cable is used in telephony because we can't use anything else. There is no other form of cable that we know of that can in any reasonable way be used. Whatever may be said of the paper cable, it is true that it is subject to one very serious drawback, and that is any slight puncture of the sheath—that is, with moisture present—is liable to put all the wires out of business. So that while such trifles as these are readily repaired, yet they are very apt to occur. The point I am making is this: that in other systems of communication such wires as rubber-covered wire or gutta-percha insulated wire is perfectly feasible to use. The high frequency of alternations of telephony is not present, and the reliability is infinitely greater than paper-covered wire. For this reason I would say that in such locations as submarine cables repairs are made with extreme difficulty and in such systems as fire-alarm telegraph, where reliability is of extreme importance, the paper cable has very little place."

The meeting then adjourned.

Electrical Notes from Great Britain.

(From Our British Correspondent.)

ELECTRICAL wiring and contracting work has for years been in a most unsatisfactory state in this country. Severe competition, with its ruthless undercutting, has meant either the putting in of cheap materials and shoddy work, or the bankruptcy of the undercutter. Probably there are few departments of industry in which so many small men have in the course of a short time come in, and gone out again with burned fingers, leaving those who were earlier in the business injured. The attention which the ironmonger, the gasfitter, the plumber and the builder, have devoted to electrical business has had a good deal to do with this competition, but it seems to be practically inevitable that for small contract work at any rate, electric wiring in England will be very much on a level with plumbing and gasfitting. The householder or owner wants the initial cost of his installation to be kept down as low as possible, and with gas competition so powerful as it undoubtedly is, the electrical station official wants the same. But shoddy work and fire risks are permanently as bad for electric lighting, as good contracting work carried out at a loss is for the contractor. Electrical contracting firms have their organized association which has its branches in London, Glasgow and a number of provincial centres, and these are doing something to give a better tone to their department of electrical business. In Glasgow, for example, there is reported to be among the contractors a distinct tendency to demand a higher standard of workmanship. People are beginning to steer clear of the lowest offer, and it is said that some of the shoddy, careless workmanship of ten years ago would not be accepted there to-day. At Manchester the public electricity department has decided to only accept the work of qualified electrical contractors, and the list prepared as a register is headed with the names of the members of the local branch of the Electrical Contractors' Association. In the view of some contractors some such registration as this will soon be necessary all over the country.

By a very narrow majority the members of the National Electrical Manufacturers' Association, have recorded their opinion that it is undesirable to hold another exhibition before 1909. The actual voting was nine to eight, and the association represents fifty-nine of the principal manufacturers of and dealers in electric light and power appliances, telephone apparatus, etc. There is a strong probability of the association finding itself compelled to act earlier than 1909, because Manchester and Salford districts, where trade is now very good indeed, want a big electrical exhibition there and although they have conferred with the association on the matter and got the 1909 reply, it is rumored that with or without the association's cooperation the electricity supply authorities mean to have a big show and pretty soon.

We have had another serious trolley tramway accident through a car getting beyond the control of the driver. This time at Carshalton. The car seems to have been going at too high a speed at a curve, and the brakes failed. Two passengers have died as a result and many were injured. The Board of Trade will hold its inquiry, and doubtless divide the blame between the driver and conductor and the brakes. The accident has once again raised the whole subject of tramcar braking appliances, which it will be remembered is being investigated by a joint committee of the tramway organizations and the Board of Trade. This committee has just got to work. It has appointed two subcommittees which sit concurrently and hold weekly meetings. Recently in connection with their inquiries, A. L. C. Fell, the London county council tramway manager, provided a specially fitted car to enable them to witness a series of tests with various brakes. The secretary of the committee (35 Parliament street, Westminster, S. W.) is inviting any one having information on brakes or sanding arrangements to communicate results and perhaps to exhibit samples.

The wiring rules of the Institution of Electrical Engineers have again been reissued in revised form. Important improvements have been effected as a result of the joint labors of the Electrical Contractors' Association, the Municipal Electrical Association, the Institution of Electrical Engineers, leading fire insurance officers and others interested. It is intended for the committee to continue its work effecting further revisions as and when the circumstances warrant.

Before a recent meeting of the Physical Society Mr. Pochin read a paper on "Experimental Mathematics." At the April 26 meeting the subject of "Electrical Conduction Produced by Heating Salts," was brought forward by A. E. Garrett; and W. B. Croft discussed "Solenoids which are Turned by the Earth's Magnetic Field." At the Institution of Civil Engineers, on April 16, a full description was given of the Pyrmont Bridge, Sydney, New South Wales, by P. Allan. The bridge is 1,210 feet long, it has three thirty-foot clear openings in the Sydney approach for vehicular traffic to wharves. Electricity is the motive power for working the swing span as well as for the roadway gates and the lighting; the whole are operated by one man from a conning tower on the centre of the swing bridge. The electrical equipment for operating the swing span consists of two fifty-horse-power motors located on a machinery platform within the drum, and driving a horizontal shaft connected by vertical shafts and bevel-gearing to the rack at the top of the pier. The motors have a guaranteed starting effort of 5,384 pounds at 3.143 inches radius from the centre of the armature shaft, also an armature speed of 509 revolutions per minute in twenty-four seconds with load, and current not exceeding 130 amperes in either motor. The quickest opening of the span has been thirty seconds costing 0.357 penny, while the most economical run took fifty-five seconds, costing 0.192 penny with a maximum effort of forty-eight horse-power. Current is supplied by the government railway commissioners at one penny per unit. During the four years from 1902 to 1906, the swing was opened 24,610 times at a cost of only £83 6*s*. 5*d*. for current.

Railway officials in this country who want working results, facts and figures showing the actual practical experience of electrified steam lines have not yet been furnished with sufficient data from English systems which they regard as fairly comparable with their own class of line. The North Eastern and the Lancashire & Yorkshire are the only lines of ordinary standard surface railways upon which electric traction has been in operation for a period of any length, and

though both have done well with the direct-current system, there is no disposition at present to extend; it may be that the waiting is largely due to the desire to watch development work which is now taking place with the single-phase, alternating-current method in London and on the Midland. The battle of the systems is being fought out between experts of eminence in the *Times* Engineering Supplement at the present moment. The want of immediate great success of electricity on the Metropolitan and District and other underground lines ought not to be allowed to act as a deterrent to other companies, and it would not do so if all the peculiarly exceptional difficulties attending the electrification of such railways and their heavy burdens of old capital were taken into account. In the same way all the unfortunate past which has hung about the neck of the Mersey tunnel must be considered if we want to know what the real results of electrification have been. In the old dirty, smoky, days these shockingly unventilated tunnels were driving traffic away and in electric traction lay their only possible means of even continuation, much less their full salvation. Four years of electrical working has altered everything excepting the financial burden; under existing conditions nothing can touch that in such a way that the investor of days gone by can get a return upon his capital. But, putting that aside, it is instructive to record just what has been effected in the way of improvement by the change. The length of route is 4.33 miles and the system connects Birkenhead and Liverpool by tunnel under the Mersey river. It was worked by steam from 1886 up to the end of 1902. For the last half of the latter year 3,357,000 passengers were carried and the receipts were £29,470. For the last half of 1906, after four years of electrical operation, there were 6,237,000 passengers carried, an increase of eighty-five per cent, and the receipts were £47,-359, an increase of sixty per cent. The receipts per passenger has averaged 1.89 pence under steam, but only 1.68 pence under electricity, the reason for this reduction being the changing over of many passengers from first-class to third-class owing to the better accommodation rendered available in the electric rolling stock. The net result for the passenger is an increased speed and frequency of service, and better accommodation for a reduced fare.

ALBERT H. BRIDGE.

London, April, 1907.

New Engineer-in-Chief of the General Post-Office, Great Britain.

Major W. A. J. O'Meara has been appointed engineer-in-chief of the post-office of Great Britain, succeeding John Gavey, whose retirement took effect on Monday, April 15. Major O'Meara was born at Calcutta, India, in January, 1863. He joined the Royal Military Academy in March, 1881, and gained a commission in the Royal Engineers in February, 1883. After two years of study at the School of Military Engineering at Chatham, he proceeded to India, and was posted for duty with the second company of Bengal Sappers and Miners. On the outbreak of war in Burmah in October, 1885, he went to that country with the fifth company of Bengal Sappers and Miners. In January, 1886, he was severely wounded, and later invalided home, where he underwent several operations in order to regain the use of his right hand. His health having broken down, however, the treatment had to be abandoned. In June, 1889, he was posted for duty with the Second Division Telegraph Company, Royal Engineers, and was employed for five years in the post-office department. During part of this time he was engaged in connection with the construction of the London-Paris telephone trunk line. In 1894 he went to South Africa, where he commanded the twenty-ninth company of Royal Engineers at Cape Town, and was engaged on the construction of the defenses of Table Bay. In 1896 he was successful in a competitive examination for entrance to the Staff College, and returned to England in December of that year to spend two years at Camberley, where he graduated P. S. C. in December, 1898. He was appointed staff officer of the Royal Engineers, Southern District, in January, 1899, and in June, 1899, was sent to South Africa as special service officer, and engaged on reconnoissance duties in the Orange Free State and Griqualand until the outbreak of the Boer War. From October 4, 1899, to February 15, 1900, he acted as chief staff officer to Colonel Kekewich in Kimberly, and also performed the duties of intelligence officer, press censor and director of telegraphs. On the arrival of the British forces in the Free State he was appointed to the staff of the military governor. On the occupation of Johannesburg, when the town officials were dismissed by the military governor, Major O'Meara was appointed to take charge of municipal affairs. He acted as mayor under these conditions for eleven months. He was offered the position of assistant engineer-in-chief of the general post-office in April, 1902, and on his acceptance retired from his appointment in Johannesburg, and in April, 1903, retired from the army.

Technical Publicity Association.

The Technical Publicity Association held its annual meeting, election of officers and monthly dinner at the rooms of the Aldine Association, at 111 Fifth avenue, New York city, on the evening of April 18. All the officers were reelected as follows: president, F. H. Gale, General Electric Company; first vice-president, E. M. Cleaver, Niles-Bement-Pond Company; second vice-president, C. B. Morse, Ingersoll-Rand Company; treasurer, H. M. Davis, Sprague Electric Company; secretary, Rodman Gilder, Crocker-Wheeler Company. H. M. Kress, of the Cameron Pump Company, and F. F. Coleman, of the Lidgerwood Manufacturing Company, were elected to the executive committee. C. W. Beaver, Yale & Towne Manufacturing Company; C. N. Manfred, H. W. Johns-Manville Company, and H. C. Spaulding, Triumph Electric Company, were elected to the membership committee. Mr. Kress was reappointed to look after the dinners and Mr. Coleman was appointed as press representatives.

The following new members were elected: J. V. Downie, advertising manager Keystone Driller Company; B. F. Hardesty, advertising manager the Lehigh Valley Railroad; P. P. Fox, advertising and industrial agent of the Delaware, Lackawanna & Western Railroad; David Gibson, advertising manager Globe Machine Stamping Company; C. W. Miller, secretary Jeffrey Manufacturing Company; H. L. Meyers, New York Leather Belt Company; J. Cecil Nuckols, advertising manager Obermeyer Company; Paul Robertson, advertising manager Atlas Engine Works; E. W. Strong, American Locomotive Company; Ernst Stutz, general manager and vice-president Goldschmidt Thermit Company; Barrett Smith, publicity manager J. G. White & Company; W. G. Snow, manager of publicity, International Silver Company, and Stuart Benson, advertising manager R. Wallace & Sons Manufacturing Company.

The association has doubled its membership during the last year and now has sixty-two members, representing many of the most important houses in the country which use the technical press for advertising. The discussions at the monthly meetings have excited a large amount of interest, and it is expected that during the coming year the membership will again double.

An offer of a booth at the advertising show to be held at Madison Square Garden May 16-23 was accepted, and arrangements were made to have officials of the association present on each day and evening to receive members of the association and their friends.

Electrical Notes from Europe.

(From Our Special Correspondent.)

THE use of hydraulic power continues to increase in the north of Italy, and there have been lately erected a number of hydroelectric plants, in this region, especially in the district around Genoa, where there are many streams which can be utilized for the purpose. A company which was formed within a recent period, known as the Ligurian Hydroelectric Company, is one of the most active in carrying out electrical operations in this region, and at present it proposes to erect several new hydraulic plants in addition to the ones which it is now operating. One of these plants is located on the Areto stream, which is an affluent of the Trebia and flows toward the north. This river is expected to furnish a considerable amount of power, and the company is taking measures to erect plants of some size here. One of the main features of the hydraulic work is a 140-foot dam which will be built across the valley of the Areto, and in this way a vast reservoir will be formed which is to contain 54,000,000 cubic metres. From the dam there will be built an offtake canal five and a half miles long. It is intended to build three separate plants upon the canal so as to take up the entire fall. The upper plant will utilize a head of water of 1,140 feet, and is to be equipped with eight turbine-dynamo groups of 2,600 horse-power each. The second plant, lying further down, proposes to use a fall of 620 feet, having five turbine groups of 2,600 horse-power, while the third plant, having a 560-foot fall, will have 9,000 horse-power in machines. One of these plants will be used for operating some of the state railroads when these are changed to the electric system or new lines built. A good part of the current will be utilized for the city of Genoa, and it will be sent over a 33,000-volt pole line. The Hydroelectric company expects to utilize several other streams in the same region, especially those which flow from the Apenines towards the Po or the Mediterranean.

City cabs on the electric system are to be operated by a new company which has been formed quite recently. The company is known as the Compagnie Parisienne de Taxautos Electriques, and several of the leading firms are interested in it, among others the Mining and Industries Company and the automobile firms of Krieger and Brasier. The new cabs are to use the Krieger system of electric motors, and will be equipped with the new mileage counters for regulating the fare according to the system which is now coming into use in the city. It is stated that the new company will have 150 electric cabs built and will set them running before long. This will be done to see how the cars operate, and if successful they expect to increase the number to one thousand.

The Italian Association for preventing accidents to workmen is to hold an international concourse for different kinds of safety appliances. A gold medal and the sum of $1,600 is to be awarded for a device which can be applied to transformer plants so as to lessen the danger of a contact between the primary and secondary coils or the lines leading from the same. The apparatus is to come into action as soon as there is a contact formed which makes the voltage between the secondary and ground rise to double the standard value in the case of three-phase current, or to two and a half times for single-phase current. The voltage must be brought back to the standard by means of the device in question. But the apparatus is to be designed so that it will not stop the working of the transformer nor must it be affected by atmospheric discharges or partial faults of insulation, as long as these are below the safety limits. Such an apparatus is to be in working order and it may be tested upon a 3,600-volt circuit.

A combined electric traction and ferry-boat line is proposed between Berlin and St. Petersburg. According to recent reports there will be three sections of electric railroad built in Germany, Sweden and Russia. Starting from Berlin, an electric line will run to the northern port of Sassnitz. From there a steam ferry line will make connection with one of the ports in the southern part of Sweden, probably Trolleberg, and from there a second electric railroad will run to Stockholm. Between the latter point and the opposite coast there will be a steam ferry line ending at Abo, in Finland, from whence an electric road is to make connection with St. Petersburg. The trip as planned in the present project will be shortened to twenty hours, as the route is more direct. At present the time by the railroad route is about thirty-one hours.

One of the most successful of the new hydraulic plants in the Mediterranean region of France is the Plan du Var station, which, like the others in the same district, is under the control of the Energie Electrique Company, in which the French, Thomson-Houston Company is interested. The water of the Var stream is used in this case, and the head of water is about eighty feet. In the plant are installed three turbines of the Francis pattern rated at 900 horse-power each. To each of the wheels is coupled a Thomson-Houston alternator of the three-phase type. The whole plant will furnish about 2,000 horse-power at present, and the voltage, 10,000 volts, is the standard which is used upon the network of lines passing through the coast region. A good part of the current is used in the carbide works belonging to the Nice Electrochemical Company, while the lines also run to a large lime and cement works of the Thorrand-Durandy firm and the pottery works of the Véran firm. Pole lines connect the Plan du Var station with some of the other hydraulic plants in the region.

The Turkish Government is taking measures to build a large electric plant in Constantinople in order to secure the current which is needed for the city lighting. This will be an enterprise of considerable importance. Bids have been asked from some of the leading German, English, and Belgian electrical firms. It is intended to have the plant erected by one of the foreign firms, but after it is finished it is to be operated by the local authorities. It is also proposed to erect an electric plant at Rome in order to furnish current for use in the city, and a number of companies will be asked for bids both as to the material for the station as well as a considerable amount of wiring which will be carried out within the city for public and private lighting. A number of steam turbine units will, no doubt, be placed in the new plant. The matter is now in the hands of the municipal council.

A project for a hydroelectric plant of some size is now under consideration at Bale, Switzerland, by the local authorities. The new plant will be located on the Rhine, and is to be operated in common with the large Rheinfelden plant which has been working for some years past. A large volume of water with a low head will be used. The hydraulic work extends over a length of five miles with a total head of twenty-eight feet. It is expected to secure nearly 100,000 horse-power in this way, counting the average flow. With the proposed outfit of turbines there will be 30,000 horse-power utilized at first.

C. L. DURAND.

Paris, April 27.

BOOK REVIEWS.

"Applied Electricity." J. Paley Yorke. New York. Longmans, Green & Company. Cloth. 420 pages. 5 by 7½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $2.10.

The title, "Applied Electricity," is used here in a sense frequently employed ten or fifteen years. The book describes those elementary physical measurements in electricity usually given in the first year of the college course in physics, but it goes a little further, as it shows the application of the laws thus deduced in actual work, and it gives elementary explanations of the apparatus employed in electrical engineering. It is, however, a text-book of science, rather than of application.

"Wireless Telegraphy." A. E. Kennelly. New York. Moffat, Yard & Company. Cloth. 212 pages. 5½ by 7¾ inches. 66 illustrations. Supplied by the ELECTRICAL REVIEW at $1.

Dr. Kennelly has produced here an acceptable elementary treatise on that new field of investigation and application—wireless telegraphy. The study of this art has been difficult, because of the manner in which it has been developed by many independent workers, and because the theory is not simple. In this book the accepted explanations are given clearly and simply, and many of the devices now employed are described. The beginner in this subject will find this book a great help.

"The 'Engineering' and Electric Traction Pocketbook." Fourth edition. Philip Dawson. New York. John Wiley & Sons. Flexible leather. 1,054 pages. 4½ by 6½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $5.

The fourth edition of this excellent hand-book, besides being a revision of the preceding edition, contains sections on storage batteries, steam turbines and switchboards. The book deals with every detail of electric and railway work, from track construction to power-house and car equipment. It gives many data showing the performance of the apparatus employed, and explains how these are employed to the solution of particular problems. The book is invaluable as a reference for the electric railway engineer.

"The Technical Year Book." Arthur C. Kelly and Charles Weekes. London. Percival Marshall & Company. Cloth. 400 pages. 4 by 6 inches. Illustrated. Price: Cloth, 5s. net; leather, 6s., 6d. net.

The object of this little book is to put in convenient form a record of the technical progress for the past year. It is a compilation of abstracts of articles of permanent value, contributed to the technical journals during that period. It contains a great many matters of interest, in each case giving sufficient discussion to enable the reader to determine the value of the original article. For those who have not ready access to an index and a well-supplied library, it should be acceptable.

"Electric and Magnetic Measurements and Measuring Instruments." Frank W. Roller. New York. McGraw Publishing Company. Cloth. 398 pages. 6½ by 9½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $3.50.

Information dealing with the construction and use of all types of electrical measuring instruments must usually be gathered with difficulty from text-books as a general rule somewhat behind the times, and from trade catalogues. In this book detailed descriptions of modern electrical instruments of all types are given, explanations of their construction, and instructions for their use. Those who are frequently called upon to make electrical measurements will find it of great service.

"The Electrician's Primer." Second edition. Edited by W. R. Cooper. New York. D. Van Nostrand Company. Cloth. 6 by 8½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $5.

This book is a compilation of eighty treatises on various electrical devices, varying in size from ten to twenty pages, each dealing with some particular device, the construction and performance of which are clearly explained in simple language. The subjects vary from the primary battery, the Wheatstone bridge and the galvanometer, to electric motors, generators, steam engines, power plants, etc. In place of an index, a glossary is supplied, which serves this purpose, and, besides, defines the quantity or apparatus sought.

"Electrical Engineering." New edition, revised and enlarged. E. Rosenberg. Translated by W. W. Haldane Gee and Carl Kinzbrunner. Revised by Edward B. Raymond. New York. John Wiley & Sons. Cloth. 360 pages. 6¼ by 9 inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $2.

This is the American edition of an elementary text-book prepared by the author from a series of lectures delivered before the workmen of a large German electrical manufacturing firm. The elementary electrical theory and the fundamental principles are first expounded, and the application of these to the production of every-day apparatus is explained. All branches of the electrical arts are touched upon, the discussions in general being concise and clear. Much of the apparatus shown looks strange to the American eye. Aside from this, however, the book should prove of assistance to mechanics and apprentices.

New Spanish Cable Line.

Consul-General B. H. Ridgely, of Barcelona, Spain, reports that the Spanish government has laid a submarine cable from Barcelona to Palma de Mallorca, in the Balearic Islands.

The cable was put down by a London company, and is 117 miles long, the cable ship laying it in less than two days. The contract price for the cable laid was $145,995, which will be paid by the Spanish government. This line has long been required for commercial purposes, and the government yielded to the urgent demand of the united business elements of Barcelona and Palma de Mallorca. Barcelona is the great commercial metropolis of Spain, with a population of about 700,000, and Palma de Mallorca is the principal city of the Balearic Islands, with a population of about 70,000, and is the seat of considerable industry. Heretofore the only cable line connecting the Balearic Islands and the Spanish Peninsula was the one from Valencia to Palma, but this was not sufficient for the commercial necessities of Barcelona.

The Spanish government has two other cable lines leaving the peninsula, one from Cadiz to Teneriffe, Canary Islands, the other from Cadiz to Tangier. Two English companies own all the other cable lines leaving Spain. These are the lines from Barcelona to Marseilles, France, and from Bilbao to Falmouth, England; also lines from Cadiz to Port Cornaw, Cornwall; from Vigo to Port Cornaw, and from Vigo to Lisbon. In the new cable from Barcelona to Palma there are six copper wires; the system of receiving and transmitting is the Morse.

Retirement of John Gavey.

On Thursday, April 11, a large number of friends and admirers of John Gavey assembled in the dining club hall at the general post-office, London, England, to bid him farewell on the occasion of his retirement from the position of engineer-in-chief to the British Post-office. Speeches were made by Babington Smith, secretary to the general post-office; H. R. Kempe, chief staff officer, and Sir John Lamb. Among the farewell gifts presented to Mr. Gavey were a roll-top desk and chair for Mr. Gavey, a solid silver tea and coffee service and a solid silver kettle for Mr. and Mrs. Gavey, and for the three daughters, two gold watches and a toilet case.

On the same evening a complimentary dinner was given to Mr. Gavey at the Grand Hotel, Trafalgar Square. The postmaster-general presided over the company, and among those present were Sir J. Denison Pender, Sir R. Hunt, H. Babington Smith, H. R. Kempe, M. F. Roberts, Major W. A. J. O'Meara, Dr. Glazebrook, R. Kaye Gray, A. P. Trotter, W. E. L. Gaine, J. Ardron, J. G. Logan, Alexander Siemens, Robert Hammond and J. E. Kingsbury.

NEW PRINCIPLES IN THE DESIGN OF LIGHTNING ARRESTERS.[1]

BY E. E. F. CREIGHTON.

It is the opinion of the writer that we have in view complete protection at the terminals of the lightning-arrester apparatus against any high potential surge above 150 per cent of the normal voltage of the system, regardless of the natural frequency of the surges and their duration of the application and also regardless of the cause of the surges. Direct strokes of lightning on a transmission line must, of course, be taken care of where they strike. Arresters at some distance away, in the station, can be expected to take care of only that part of the charge which reaches the station. How thoroughly a grounded overhead wire will protect the line from direct strokes has not been fully determined.

Arresters can be built to take care of high-frequency surges, low-frequency surges, grounded-phase surges during an hour or so, and standing waves. This leaves the causes of interruption of the electrical circuit limited to short-circuits. These short-circuits may be limited to accidental conditions, such as a wire thrown across the transmission line, overheated apparatus, etc.

The novel features of a new multi-gap arrester consist, first, of the discovery of a true non-arcing condition of shunted gaps; secondly, a combination in a cumulative manner of several shunt resistances, and thirdly, the design of ohmic resistance by the volume method rather than by the radiating surface.

It is possible to discharge induced static electricity directly to ground without the intervention of resistance rods or wires and still prevent the dynamic current from the generator following, with the resultant short-circuit. This condition requires the adjustment of the resistance in parallel with the gaps such that the current will be transferred through the resistance before the heat expended in the gaps is sufficient to bring the arc voltage to a low value.

The extinction of an established arc in a multi-gap arrester can not take place until the potential reduces to zero at the end of the half cycle in which the discharge takes place. Incidentally it may be remarked that if the arrester functions properly the arc should not extend over the second half cycle.

Oscillograms show that if the arrester circuit is inductive the arc is not extinguished until the potential has passed through zero and is well along in the second half-cycle. Since the arc voltage is only sixteen volts per gap for heavy currents, the condition is nearly equivalent to a short-circuit. When the current dies out the voltage across the gaps suddenly jumps to the value generated. The arc has no time to cool, and presumably the ionized air around the arc starts the current in the opposite direction. This condition is to be compared later to the condition of arc extinction in the liquid electrode arrester, where the current reduces to zero before the potential.

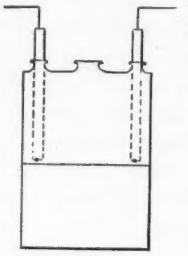


FIG. 1.—LIQUID ELECTRODE CELL.

Except in the case of recurring high potential surges the multi-gap arrester should extinguish the dynamic arc within the time of a cycle of the generator wave. This period of time is so brief that radiation of heat need not be considered in the design of the resistance. The basis of design is the utilization of the specific heat or the heat capacity of the resister. In the lower resistances of the lightning arrester it would be impracticably expensive to design the resistance to radiate the energy that would be lost therein if the current were applied even for several seconds.

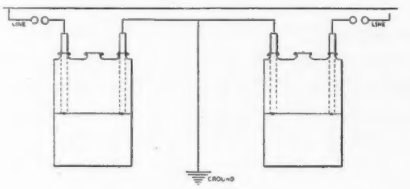


FIG. 2.—LIQUID ELECTRODE ARRESTER.

LIQUID ELECTRODE ARRESTER.

This arrester may have any one of several forms all involving the same principle. One form is shown in Fig. 1. Two metallic electrodes extend into a vessel containing an electrolyte of high conductivity. The electrodes may be dipped into the electrolyte or there may be a small gap left between the electrode and the electrolyte. If current is passed from one electrode to the other in either direction, the liquid must become negative at one or the other electrode. It requires about 1,500 volts to maintain the current through the cell, in spite of the fact that the resistance of the cell is extremely low. The current is limited by the so-called counter electromotive force of the arc.

Electrodes not in Contact—The difference in effect produced by the conditions of contact between the electrodes as compared to the air-gap setting is marked. For example, three of these cells were placed in series across a circuit having an impressed voltage of 2,300 volts effective. Each electrode was set with a small gap. The equivalent needle gap was the same as for four one-thirty-second-inch gaps between standard brass cylinders without series resistance. With this arrangement several hundred static discharges having an initial value estimated at 1,000 amperes were passed through the cell, but no dynamic current followed the discharges. The novel relation of counter electromotive force practically as great as the spark voltage of the cell is obtained. The sum of the counter electromotive forces per cell is greater than the impressed voltage of the circuit, consequently a spark passes without causing the formation of an arc.

Under similar conditions in the multi-gap arrester using four one-thirty-second-inch gaps the spark voltage of a single gap may be in the neighborhood of 2,000 volts and the spark voltage of the four gaps in series may lie between 5,000 and 6,000 volts. The electromotive force absorbed by a single arc in practice will be scarcely greater than sixteen volts per gap or seventy volts total for the four gaps. The spark voltage is about 125 times as great as the arc voltage for a single gap or about eighty times as great for the total of the four gaps.

Herefrom it follows that the multi-gap arrester does not work on the principle of counter electromotive force, but upon the principle of rectification. The arrester is therefore suitable for alternating-current circuits but not at all adapted to direct-current circuits. When the currents attempt to reverse at the beginning of the second half-cycle, several hundred or even thousand volts may be required to cause the reversal. During the first half-cycle it is necessary to have an artificial resistance in series to limit the dynamic current.

A liquid electrode arrester set with four gaps of equal value to the above-

[1] From a paper read before the American Institute of Electrical Engineers, March 29.

mentioned case will have a spark voltage of one-and-one-third times as great as the electromotive force absorbed by the arc, considering a single element only; or about 1.8 times as great considering both cells. On a 2,300-volt (effective) circuit the maximum voltage is about 3,200 volts.

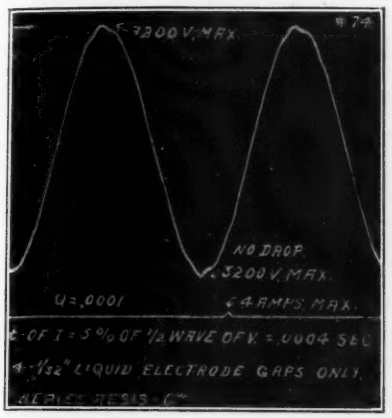


FIG. 3.—Liquid electrode arrester using gaps at the surface of the electrolyte. Two cells in series. The current rises only to 0.4 ampere and there is no disturbance in the potential wave.

The maximum arc voltage of the two cells containing a particular electrolyte is about 3,000 volts. A spark can form into an arc only at the peak value and is extinguished long before the generator voltages reaches zero. Any voltage above 1,500 volts per cell produces a rush of current in proportion to the pressure above 1,500 volts. In other words, the cell has a

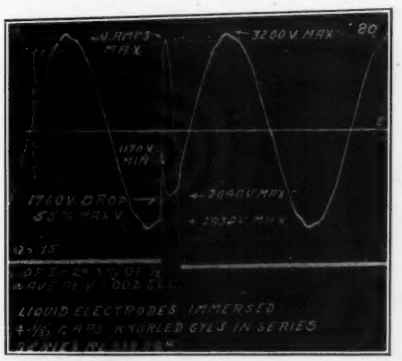


FIG. 6.—Liquid electrode arrester with immersed terminals. The heavy lightning-arrester choke-coils are in series. These reactance coils add to the line drop of potential. This oscillogram shows a method of obtaining any desired quantity of dynamic discharge before the interruption of the current. The current has increased from 0.4 ampere (Fig. 3) to 120 amperes maximum due to the immersion of the metal terminals. In spite of this heavy current discharge the current decreases to zero before the potential reaches zero.

critical voltage above which there is a free discharge of electricity without the intervention of anything more than a slight ohmic resistance.

Electrodes in Contact—When the metallic electrodes touch the liquid it is necessary to introduce a single gap in series to hold back the line potential. Since the counter electromotive force of arcs in the arrester limit the current, this single gap suffices even at the high potentials used on long-distance transmission circuits. A simple arrester circuit is shown in Fig. 2. The series-gaps may be set at any value above line potential. When the potential breaks

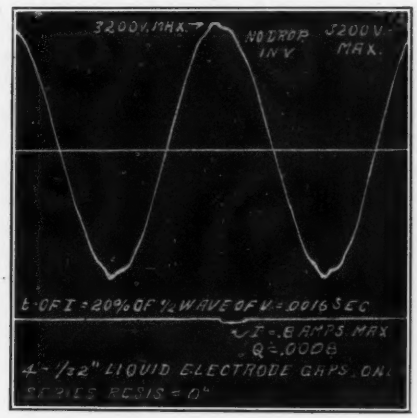


FIG. 4.—Liquid electrode arrester using gaps at the surface of the electrolyte. Although the spark takes place at peak voltage only 0.8 ampere of dynamic current follows. Comparing the current discharge to Fig. 3, the current is twice as great and persists for a longer time. This is due to the fact that the discharge takes place at a higher point on the potential wave. The counter electromotive force of the cells is aproximately equal to the peak voltage (3,200 volts) of the circuit. There is no disturbance of the potential wave.

across the gaps the current begins to discharge at short-circuit rate. The current density at the electrodes is such as to start an arc which throws the electrolyte away from the electrode and automatically

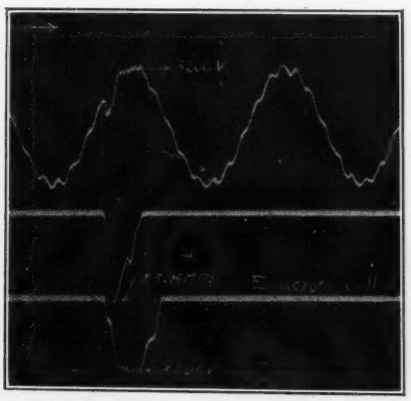


FIG. 7.—Liquid electrode arrester with the metallic electrodes in contact with the electrolyte. The static discharge takes place on the rising part of the potential wave. The drop in the upper potential wave is due to the inductance of the circuit. The potential wave quickly recovers its normal form. The current reduces to zero in advance of the potential. The potential across the cell reduces to zero with the potential of the generator wave. The maximum counter electromotive force of the cells is equal to the impressed voltage of the circuit.

lengthens the arc. The arc voltage is greater than the impressed voltage and the current dies out. The series gaps hold back the line voltage. The electrolyte assumes again its level in contact with the electrode. The current starts on short-circuit but decreases so gradually that no surges have been detected either by the oscillograph or by parallel-needle gaps. Extensive experimental tests have been made on a commercial circuit of 2,300 volts, 13,000 volts, and 33,000 volts normal voltage. The last-mentioned circuit consisted of thirty miles of three-phase line and was subjected to surges due to numerous arcs drawn out between a

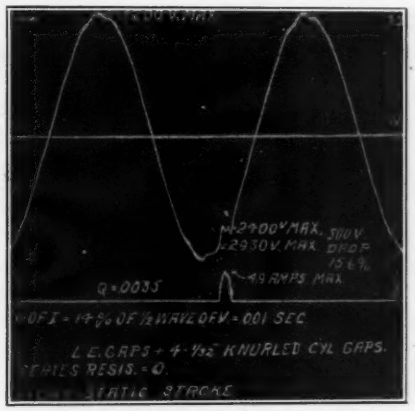


FIG. 5.—Liquid electrode arrester using series gaps in conjunction with the small gaps above the electrolyte. There were two large lightning-arrester choke-coils of the pancake type in series. These choke-coils give the exaggerated drop of potential (500 volts) at the instant of discharge.

phase and ground. These arcs to ground attained maximum lengths of five feet.

The arc voltage of the liquid electrode depends somewhat upon the length of the arc. Since it is the current which depresses the surface of the electrolyte, the length of arc depends greatly upon the value of the current. As the current decreases the electrolyte rises toward the metallic electrode. After the first instant the phenomena are of the nature of cushion effects.

The quantity of electricity which passes

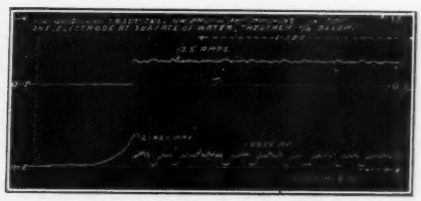


FIG. 8.—Liquid electrode cell on direct current showing the time required for the arc to bore one-fourth inch below the surface of the electrolyte. The average potential with the liquid as the negative electrode is 885 volts, but when the arc reaches the metal electrode in the liquid the voltage drops to 285 volts or less. Shortly after the liquid again sweeps over the lower metal electrode and raises the voltage again.

through the arrester before the electromotive forces absorbed by the arcs becomes active depends upon the amount of surface of metallic electrode exposed to the liquid. This value can be increased by immersing the metal to a greater depth.

The resistance of the arrester is located initially in the liquid only, but gradually divides between the series arc and the electrolyte. The electrolyte is a large

body of large cross-section and low specific resistance.

The electromotive force absorbed by the arc at the electrolyte varies somewhat with the nature of the electrolyte.

Although the initial current may be considerable, the total current in continuous operation is not. To determine the endurance of the arrester, a 13,000-volt unit was connected to one phase of a circuit without any series gap or resistance. This circuit consisted of a 2,000-kilowatt generator connected to nearly a mile of cable and seven miles of overhead line. The other two phases were protected by gaps set at 160 per cent of line voltage.

The potential of these phases did not jump the gaps during the severest tests. It should be noted that the arrester was in action under the abnormal condition of no series gaps. The action of the arcs gradually lowered the level of the liquid until 13,000 volts would no longer maintain the arcs. The time required to do this depends on the construction of the cells. In the small cells it is about five minutes and in the large cells somewhere between ten and twenty minutes. This time can be increased if found advisable. This sustained operation should make the liquid electrode arrester suitable to take care of the recurring surges on an isolated delta or Y system, when one phase is grounded through more or less of an arc, during a time amply sufficient to disconnect the faulty line. In the foregoing experiment a twenty-ampere fuse in series with the arrester was unaffected. Apparently the possibility of an interruption in practice due to the short-circuit of the arrester can be eliminated, as it was in this test.

In practice, the number of cells would be chosen to give a critical limiting voltage of 125 per cent to 140 per cent of the impressed voltage. The gap length may be set to give any desired protection. Since the arrester has but a single gap, the spark potential is as near independent of the natural frequency of the lightning surge as possible. It should discharge with facility low-frequency surges. It has a small dielectric spark lag.

The characteristics of the liquid arrester have been studied in detail with the aid of an oscillograph. A few oscillograms have been chosen which show the effect of a cell of the current and potential of a commercial 2,300-volt circuit.

Important Patent Pooling Arrangement Upheld.

When the patent agreement was entered into between the General Electric and Westinghouse companies ten years ago, the Sherman Act was already in force and there were being enacted anti-trust laws in various states, which it was thought could be interpreted to prevent the General Electric and Westinghouse companies coming to a positive agreement to regulate prices upon their products as protected by their respective patents.

A decision has recently been rendered by the United States Circuit Court of Appeals for the Seventh District which deals with this question in a way to protect the owners of patents and inventions. The following extracts from this decision are pertinent and instructive:

" . . . . is the owner of a valid patent. That stands as an unquestionable fact on this writ of error. The only grant to the patentee was the right to exclude others, to have and to hold for himself and his assigns a monopoly, not a right limited or conditioned according to the sentiment of judges, but an absolute monopoly constitutionally conferred by the sovereign lawmakers. Over and above an absolute monopoly created by law, how can there be a further and an unlawful monopoly in the same thing. . . . Is a greater injury or deprivation inflicted, if plaintiff authorizes a combination or pool to do what plaintiff can do directly? To say yes means that substance is disregarded, that scare words confer upon the people some sort of a right or interest counter to the monopoly, when by the terms of the bargain the people agreed to claim none until . . . 's" (the patentee's) "deed to them shall have matured. . . . .

"None of the provisions of the contract, in our judgment, touched any matter outside of the monopoly under the patent. The control of prices and output, for reasons already stated, did not deprive the public of any right. Both before and after the period covered by the contract the market was demoralized, prices were cut, and the owner of the patent was getting nothing except by the slow and expensive process of litigation; but the public was not entitled to profit by competition among infringers. The internal agreements relating to royalties, proportioning the business, supervision and penalties did not affect or concern the public at all. . . . the owner of the patent had the right, either alone or through licensees, to accumulate funds with which to push the . . . tire on the market and in so doing to undersell the makers of other tires and infringing makers of the . . . tires. The public is not injured by an arrangement to compete with adversaries for the public's patronage. . . .

"Now were the patentee the manufacturer, he would unquestionably have had the right to fix and maintain his own prices; and were the other parties to the contract manufacturers for the patentee, at a given figure for such manufacture, the patentee's right to fix and maintain the selling price would still remain; nor could this be questioned were he to make the manufacturers his selling agents also. How, then, does the contract under review make a case in which the patentee through his manufacturer is not entitled to fix and maintain prices—how is the arrangement, in effect, different in any way of restraining trade or competition, from the arrangement just supposed, in which the patentee unquestionably has that right?

"True, in the case under review, the manufacturers *as to the public,* are not competitors; but neither would they be in the cases supposed; in both cases the public suffering nothing except what the patentee had the right to exact; for so long, at least, as the patentee is not exacting, as the value of his invention, an unreasonable sum (and his action in that respect is not here questioned) it is within his own right to say whether the price exacted should be retained by himself, or shall be distributed among the people manufacturing for him. The contracts, therefore, in the case before us, having been made in good faith, and not as a mere subterfuge, I can see in them nothing that the Sherman Act was intended to prevent."

The Morse Electric Club.

The permanent organization of the Morse Electric Club was effected at a meeting held in New York city, at 195 Broadway, April 25. A. T. Benedict presided, and a constitution and by-laws were adopted. Officers were elected as follows: president, J. B. Van Every; vice-presidents, J. C. Barclay and B. Brooks; secretary, F. J. Scherrer; treasurer, R. J. Murphy; directors for one year, Gardner Irving and M. H. Kerner; two years, John A. Hill and P. J. Casey; three years, M. J. O'Leary and A. G. Saylor. Col. Robert C. Clowry was elected an honorary member.

Programme of the Spring Meeting of the American Society of Mechanical Engineers.

The spring meeting of the American Society of Mechanical Engineers will be held in Indianapolis, Ind., May 28-31. The headquarters room will be on the parlor floor of the Claypool Hotel, and the professional sessions on the top floor on the south side of the building.

The local committee in Indianapolis is preparing a booklet giving the different points of interest, the hotels, their names, rates and locations, and also a map of the city.

A number of excursions to points of interest in and around Indianapolis have been arranged.

The official headquarters will be opened in the Claypool Hotel at noon on Tuesday, May 28, and maintained throughout the meeting. Members and guests are requested to register as early as possible and to make this the occasion for turning in their railroad certificates.

The opening session will be held Tuesday evening, May 28, at 9 o'clock, in the auditorium of the Claypool Hotel. The address of welcome will be responded to by Professor Frederick Remson Hutton, president of the society.

An informal reception will be held after the opening address, which will give an opportunity for members and guests to meet and exchange greetings. Ladies will be especially welcome.

SECOND SESSION—WEDNESDAY, MAY 29, 9.30 A. M.

Annual business meeting. Reports of the tellers and standing and special committees. New business can be presented at this session.

Report of the "Committee on Standard Proportions for Machine Screws."

Preliminary report of the "Committee on Refrigerating Machines."

"Collapsing Pressures of Lap-Welded Steel Tubes." Professor Reid T. Stewart.

"The Balancing of Pumping Engines." A. F. Nagle.

"A Comparison of Long and Short Rotary Kilns." E. C. Soper.

Wednesday afternoon, May 29—Visits to various plants.

THIRD SESSION—WEDNESDAY, 8.15 P. M.—AUTOMOBILE SYMPOSIUM.

"Bearings and Moving Mechanism." Henry Hess.

"Air Cooling of Automobile Engines." John Wilkinson.

"Materials for Automobiles." Elwood Haynes.

"Special Auto Steel." T. J. Fay.

"Railway Motor Car." B. D. Gray.

FOURTH SESSION—THURSDAY, MAY 30, 9 A. M.—SUPERHEATED STEAM.

"The Specific Heat of Superheated Steam." A. R. Dodge.

"The Flow of Superheated Steam in Pipes." E. H. Foster.

"Correlation of Furnace and Superheater Conditions." R. P. Bolton.

"Valves and Fittings for Superheated Steam." J. H. Berryman.

"Use of Superheated Steam on Locomotives in America." H. H. Vaughan.

Excursion Thursday afternoon, May 30.

Reception Thursday evening, May 30, 9 o'clock.

FIFTH SESSION—FRIDAY MORNING AND AFTERNOON, MAY 31—EXCURSION TO PURDUE UNIVERSITY, LAFAYETTE, IND.

A professional session will be held at 10 A. M. in one of the university buildings.

"Performances of Cole Superheaters." W. F. M. Goss.

"Experiences with Superheated Steam." G. H. Barrus.

"Superheated Steam in an Injector." S. L. Kneass.

"Determination of Entropy Lines for Superheated Steam." A. M. Greene.

"The Heating of Store Houses." H. O. Lacount.

Other papers are expected, but as they have not been received from the authors they are not listed in the programme.

The Central Passenger Association, in whose territory Indianapolis is located, announces a rate of two cents per mile in each direction from points in its territory. Tickets of signature form will be sold on May 27, 28 and 29, and will be good for return to leave Indianapolis to and including, but not later than, June 1. Provision will be made for the validation of these tickets at the Indianapolis ticket office. This association comprises the following territory:

The portion of Illinois south of a line from Chicago through Burlington to Keokuk and east of the Mississippi river, the states of Indiana and Ohio, the portion of Pennsylvania and New York north and west of the Ohio river, Salamanca and Buffalo, and that portion of Michigan between Lake Michigan and Huron.

The Trans-Continental Passenger Association announces one first-class thirty-day fare for the round trip from California, for instance, to Chicago and return, $72.50, to St. Louis and return $67.50. These tickets are on sale on two days only, May 20 and 21, and may be purchased, going *via* any regular direct route, returning *via* the same or any other regular direct route. Stop-overs will be allowed between the California line and Chicago. The purchaser must reach his destination within ten days of date of sale. Tickets are good for return within ninety days of date of sale. This Association also announces the regular nine months' rate to Chicago and St. Louis; these approximate two cents per mile in each direction, or about one fare and one-third for the round trip. The territory includes California, Nevada, Oregon, Washington and west of and including Mission Junction, B. C., including also Kootenay common points, Nelson, Rossland, Sandon, Caslo and Grand Forks, B. C.

One or more private Pullman sleeping cars will be reserved on each of two trains from the East. These reservations will be made only in case the number of applications received for Pullman accommodations reach the minimum set by the company.

The first train selected is the "St. Louis Express," which will leave New York on Monday and arrive in Indianapolis during the afternoon on Tuesday. The first session of the meeting will be on Tuesday evening. The schedule for this train will be as follows:

Lv. New York, Monday, May 27....6.25 P. M.
" Philadelphia .....8.58 P. M.
" Pittsburg (Cent. Time).....4.50 A. M.
Ar. Indianapolis, Tuesday, May 28.3.05 P. M.

The second train selected is the "Pennsylvania Limited," leaving New York on Tuesday and arriving in Indianapolis on Wednesday in time for the first professional session. New York members going by this train can have two hours in their offices on Tuesday.

Lv. New York, Tuesday, May 28..10.55 A. M.
" Philadelphia ..... 1.10 P. M.
" Pittsburg (Cent. Time)..... 8.55 P. M.
Ar. Indianapolis, Wednesday..... 6.55 A. M.

The train out of Chicago *via* "Big Four," upon which a special car will be run if the number of reservations warrants it, will reach Indianapolis in time for the opening session Tuesday evening. It is believed that our members and their guests will be glad to cooperate to secure this additional opportunity for social intercourse with old friends. The schedule will be:

Lv. Chicago, Tuesday, May 28.....1.00 P. M.
Ar. Indianapolis .....6.20 P. M.

The Old Time Telegraphers' and Historical Association.

The Old Time Telegraphers' and Historical Association will hold its next reunion at Niagara Falls, N. Y., on Monday, Tuesday and Wednesday, September 16, 17 and 18. Plans have not been completed covering the programme, but the committees are at work and announcement will be made in due time.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

The Electrification of the Mountain Ash Collieries.

The Mountain Ash Collieries of the Nixon's Navigation Colliery Company, at Pontypridd, Wales, will be electrified by Crompton & Company, with whom a contract has just been closed. The equipment consists of a generating station, surface and underground mains, and a number of motors. The engine house is placed close to the pit head. The shaft is 370 yards deep, and the motors are in various positions, grouped around the foot of the shaft. There are three Belliss & Morcom compound engines driving 300-kilowatt, three-phase alternators. The pressure between wires is 550 volts at twenty-five cycles. The exciting current in each case is supplied by a small direct-current generator coupled to the engine shaft. From the engine house four trunk mains are led underground, the cables being one-quarter square inch, three-core conductors insulated with vulcanized bitumen and fibre, and double-tape armored. The motors are used for hauling and pumping. There are three 250-horse-power motors working main and tail gears and for the principal roads. These are Crompton standard three-phase machines fitted with wound rotors and outside totally enclosed slip rings. They are direct-coupled to the gears and are started, regulated and reversed by large controllers working in an oil bath. There are at present two electrically driven pumps located in a new pump room on a lower level which has been carefully designed and built. Each of the pumps is capable of delivering 400 gallons of water per minute to a head of 1,500 feet, and is driven by a 250-brake-horse-power, three-phase motor running at 400 revolutions per minute. There is also a single-lift winding gear in the staple pit, driven by a seventy-five-horse-power motor, and there are two blocking engine reversing gears each driven by a forty-horse-power motor.—*Abstracted from the Electrical Engineer* (*London*), *April* 19.

Two-Pole Turbo-Alternator with Stationary Field and Magnetically Shunted Exciter.

A short time ago A. Heyland proposed a method of regulating alternators, in which the leakage due to the armature reaction was made to increase the voltage of the exciter, and thereby compensate for the drop in potential in the generator which would otherwise take place. This arrangement was described in the ELECTRICAL REVIEW for November 10, 1906. It depended upon having the air-gap at certain of the field poles of both alternator and exciter shorter than at the others, thus producing an unsymmetrical leakage. A modification of this system is here discussed by Mr. Heyland, suitable for machines having a small number of poles, such as turbine-driven alternators, which can not be unbalanced mechanically. This is accomplished by causing a stray flux from the alternator field to superpose itself directly upon the exciter field. The alternator may be either of the ordinary rotating-field type or with a stationary field and revolving armature. In the former case the exciter would also be of the revolving-field type, and the current would be collected from the armature by means of a fixed commutator and rotating brushes, or else by a number of equi-distant brush sets and a rotating commutator with two segments, in place of the rotating brushes. Since the exciter has but two poles, the total number of brushes of the fixed brush sets would not need to be large. In the alternative arrangement the exciter is of standard design; while the alternator is provided with a stationary field and rotating armature. One objection to this is the bringing near to the high-voltage armature the armature of the exciter. The advantages are that in ordinary two-pole alternators the external diameter of the armature is roughly twice the inside diamter of the core, so as to give the necessary cross-section of the rotating field. The weight of the armature is therefore about three times that of the rotating-field system. In the alternator with stationary field the conditions are reversed, the weight of the armature being only about one-third of what it was previously. Hence the proposed machine would give a greater output for the same weight or be made lighter for the same output. The armatures of the two machines are mounted side by side upon the same shaft. The magnet frame of the alternator is extended so as to embrace the exciter armature. A strong flux is then set up, passing first through the alternator armature in one direction and returning in the opposite direction through the exciter armature. The amount of this leakage depends upon the load on the alternator. Moreover, the phase of the leakage magnetomotive force is such that the regulation effected by the leakage field automatically corrects for variations in power-factor. With such an arrangement the regulation is instantaneous, as it is produced by the very cause which tends to lower the voltage. The design may be such as to give a flat characteristic or to over-compound the system. This is done by providing a stronger excitation for the main poles than for the exciter poles. This may be accomplished by adding a second exciter winding to the main poles. By regulating this auxiliary winding it is possible to obtain any desired compounding effect. Such an exciter behaves at all loads like an ordinary exciter with a stiff field. The arrangement is simple and suitable not only for two-pole, but for four and six-pole machines. The possibilities of the proposed design are illustrated by working out the details of a 500-kilowatt, two-pole turbo-alternator running at 3,000 revolutions per minute, fifty cycles per second. The total weight of iron is 2,000 kilograms, of copper 350 kilograms. The iron losses are one per cent; the copper losses at full non-inductive load, one per cent; at full inductive load, 1.4 per cent. These figures are contrasted with those of a turbo-generator of the same rating but of the ordinary design, in which the weight of iron is 2,700 kilograms, of copper 750 kilograms; the iron losses are three per cent; the copper losses at full non-inductive load, 1.8 per cent, and at full inductive load three per cent.—*Abstracted from the Electrician* (*London*), *April* 12.

The Technical Student and the Engineering Apprenticeship Course.

The purpose of this article is to present a frank and intimate view of the present-day attitude of technical students toward the engineering apprenticeship courses now offered by practically all of the ranking engineering manufacturers of the United States. H. Cole Estep considers that if this attitude is one of indifference, if the college sentiment is turning away from, rather than towards, the apprentice-

ship idea, the continued success of the system is in danger. The success of the system varies directly with the quality of the men entering the courses, and this quality varies directly with the amount of sympathetic interest existing among the technical students of the country. The young man graduating from his technical course generally thinks that the sacrifices involved in serving two years as an engineering apprentice are too great for the benefits to be derived therefrom, and so turns to the apprenticeship course only as a last resort. While it is true that many good men enter apprenticeship courses upon graduation, and choose wisely, yet it is safe to say that there are three times as many who should take these courses and yet are not attracted to them, but avoid them. One of the first reasons for this state of affairs is that the courses offered by many firms are too stiff and inflexible. Every man is ground through the same mill, regardless of his individual requirements or previous experience. The resulting dissatisfaction is infectious, and the knowledge of it spreads through the student world much more rapidly than does the testimony of apprentices who are satisfied with their work. The average student's idea of the details of the various apprenticeship courses is very hazy. The present-day lack of effort to acquaint the undergraduate with exact knowledge of these courses is a serious mistake in the administration of the system. Investigation among technical students reveals, aside from the question of wages, three principal objections to the apprenticeship courses: First, the courses are too long; second, there is no reward at the end, and, third, the invention clause existing in many apprenticeship contracts is unfair. To the average college man who has spent four of the best years of his life acquiring a technical education, at an expense of from $1,000 to $3,000, the pay offered the engineering apprentice must seem ridiculously small and discouraging. It is claimed that the present rate of pay is all that the average apprentice is worth, and that to this he should add the value of the education he is receiving. It is also claimed that the apprentice often takes the time of very valuable men, which must be charged against him. This latter argument has little foundation in fact. The apprentice usually is given a few brief instructions by the foreman or superintendent, and then, save for an occasional hint, is left to shift for himself. But be this or the other arguments what they may, the fact remains that the present rates and methods of paying engineering apprentices are responsible more than any other cause for the lack of sympathy in the apprenticeship courses now existing among the student body of the colleges. The first thing to do in remedying matters would be to change the whole system of wages and abolish the repellent and discouraging flat-rate system now so extensively practiced. If the modern piecework and premium system were adopted, the apprentice who had the ability and skill could then earn as much as the journeyman machinist working in the shop at his side; if not, he would only have himself to blame. In the drawing room and office he should be paid the average fair rate, based on his individual experience and ability. Then charge up to him the legitimate expenses of his course, the waste and breakages, the cost of the instruction and other items. This plan, though requiring time, tact and judgment to demonstrate, would be well worth while.—*Abstracted from the Engineering Magazine (New York), May.*

Efficiency in Steam Boiler Practice.

No boiler, says Percival Cooke, in this article, however well designed and constructed, will operate efficiently if not properly worked and cared for. One of the most important essentials to the efficient working of a boiler is a thoroughly reliable and intelligent fireman. Theoretically the efficiency of a boiler is the ratio of the actual quantity of heat transmitted to the water to the total quantity of heat available for transmission, but the term conveys also a broader and more comprehensive meaning than this, and briefly expresses the relative condition of a boiler with reference to its abilities to perform its duties consistently and economically. The steam-raising value of coal should not be based merely upon its calorific power, as the quantity of ash and other non-combustible matter it contains is also a factor of importance. As a general rule, coals yielding more than eleven per cent of ash should not be used for boilers fitted with ordinary furnaces and fire grates, even when working under forced draft. For these furnaces clean, washed coals are the most suitable and satisfactory. But almost any reasonably clean and inexpensive coal may be advantageously burned in specially constructed forced-draft furnaces fitted with finely divided, self-cleaning grate bars. The condition of the feed-water as it enters the boiler is a factor of the greatest importance which influences considerably the degree of efficiency to be attained in the process of steam raising. In all cases feed-water should be clean and hot. Especially should it be free from oil and grease. Town reservoir water requires little or no purifying, but canal water or well water should be carefully treated and cleansed before use. One of the oldest and simplest methods of softening water is Clarke's process, which is ineffective, however, in the case of sulphate waters, as it merely precipitates the carbonates. Under ordinary conditions the best way of dealing with boiler feed-water is to precipitate the impurities by the addition to the water of sodium hydrate, better known as caustic soda, which absorbs the carbonic and hydride, forming sodium carbonate and water, the calcium and magnesium carbonates, no longer capable of remaining in solution owing to the withdrawal of the carbonic and hydride, being deposited. Sodium carbonate is often used for softening feed-water, in which case only the latter stage of the above operations takes place. The purifying reagents should be introduced into the feed-water continuously, and not at intervals, to obtain the best results. The exact quantity necessary can only be ascertained by the chemical analysis of the feed-water. Recent experiments have shown that fuel economy may be gained by the use of live steam for feed-water heating. If the function of the boiler is to be properly performed, the heat-transmitting surfaces must be in a condition of maximum efficiency. The heating surfaces must be thoroughly clean on both sides. Soot on the external heating surfaces is a potential factor in reducing efficiency of heat absorption. In some cases the loss of economy due to this cause exceeds the loss due to the presence of scale on the water sides of the surfaces. Boilers should be given two or three coats of plaster of Paris before applying a covering. Coverings applied in the form of a plaster should be laid on wire netting in order to facilitate removal when necessary. Continuous feeding, steady firing, the maintenance of a constant water level, and the use of anti-priming pipes, minimize the ill-effects of priming. The most effective and efficient method, however, of overcoming the difficulties caused by priming is to superheat the steam. Although well-designed mechanical stokers are undoubtedly productive of many advantages, they are not by any means capable of rendering inefficient boilers efficient, and, generally speaking, the application of mechanical stokers to steam boilers ought not to be considered until all other requirements of efficiency have been fulfilled.—*Abstracted from Cassier's Magazine (New York), May.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

Some Selling Plans and Schemes.

Believing that all wide-awake central station managers and solicitors are always anxious to hear of good, practical plans and schemes to further the sale of electric current, a few are given here which, although not entirely new, will perhaps interest a large number of central station men. They are all wrinkles which have been worked by some central stations with a goodly degree of success, and no doubt can be adopted by others to profitable advantage.

A plan worked out in good shape was that adopted by one of the brotherhood down in Ohio last year. He set one of his young ladies to work clipping the birth notices from the paper, and in that way compiled a good list of families with young babies. About a month or so after the baby was born, an attractively gotten up "Birth Book" was sent to the happy parents. In this book was provision for the entering of various data about the baby; when it got its first tooth, the first word used, when it began to creep, walk, etc.; and inserted in the book was a circular calling attention in an effective and convincing way to the electric baby-food warmer, and inviting inspection of same at the company's office.

This plan not only sold a lot of food warmers, but also went far toward landing a big bunch of new lighting business.

It made a hit.

Why not try it yourself?

A solicitor in a good-sized Michigan town, who had been trying his best to interest local hotels of his city in electric light, electric sign and outline lighting without success, worked a clever scheme to line them up.

He went to the manager of one hotel and made him an exceedingly low rate for twelve months for his interior lighting, sign and outline lighting, and he procured the contract.

This made the other hotels look like prisons, and, of course, it was but a short time before they had to get in line.

Naturally, the first hotel was compelled to continue the lighting, even though at the end of the contract it had to pay more for the current.

This scheme could be worked by central station men to secure the lighting of competing merchants, especially drug stores, cigar stands, dry goods stores and other who have the money to spend in good show windows and electric signs, and who actually do business at night.

An eastern central station manager has for several years made a practice of having his stenographer clip from the daily press notices of marriages, and write personal letters to the newly married man advising him to start life out right with an electrically lighted and equipped home.

He goes into the subject in detail and explains the way electricity lightens woman's work around the house. He makes a strong appeal to the bridegroom's sense of chivalry, which is supposed to be about at "peak load."

He says a number of bridegrooms became influenced by his letter and had their homes wired.

This scheme is not recommended so much for the amount of direct business it brings, as it is for the influence it has in creating an impression that houses wired for electricity are the only modern homes.

Some central stations in large cities are adopting a very effective plan of convincing merchants of the value of electric light in showing the actual value of colors. A small booth is fitted up so that daylight can be admitted or every atom of daylight kept out, at will. Invitations are sent out to the merchants to attend the interesting demonstration, and they are usually largely attended. In the booth are installations of Welsbach gas arc, the glower lamp, the electric arc, Gem incandescents, etc.

A number of colored materials are shown in this booth, and the demonstrator can quickly change the illumination so as to prove his case.

He can show, for instance, the sudden change in color values where the Welsbach takes the place of daylight, and very much less marked change when the glower lamp is used, and still a smaller deviation with the white arc, etc.; in fact, prove almost

HACIENDO DESAPARECER LA FRIALDAD POR MEDIO DE ELECTRICIDAD

TAKE THE CHILL OFF BY ELECTRICITY

Illustration showing two of the inside pages of a residence bulletin of the Mexican Light and Power Company, Mexico City, Mexico. This bulletin will compare very favorably with the best published by any central station in America. Note the Spanish matter on one side and the English on the other. This style is followed throughout

anything he may particularly desire to prove.

If you find that the merchants of your town are hard to line up for interior or show-window lighting, this plan might be effectively used.

Another folder of the Mexican Light and Power Company, which forms part of its store service. The title of this folder is: "How About Sunset to Midnight?"

Now, to show you what can be accomplished by wide-awake solicitors, a case will be pointed out of a restaurant keeper in one of the large cities, who was burned out, and on that account was unable to secure his old location for a number of months.

There was no other desirable location to be had without moving several blocks away.

This looked like a "facer," in view of the fact that the place was a very desirable one for a good restaurant, and to move too far away from the former place would have necessarily meant a big loss of trade.

One of the lighting company's solicitors happened to be an acquaintance of the restaurateur, and met him the morning after the fire, bemoaning his plight.

It so happened that exactly across the street from the old stand there was a large unused basement space, which at once attracted the solicitor's attention.

He was able, in a very short time, to demonstrate to the restaurant keeper what an effective stand it would make if a proper entrance was devised and the whole space flooded with electric light.

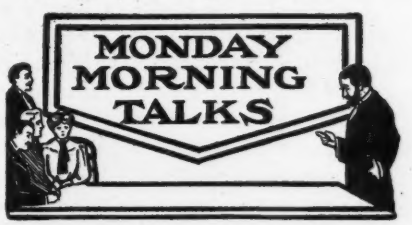
And through the solicitor's exertion the deal was closed, and he landed for his company a splendid contract for a day-and-night consumption of current for lighting that basement.

This is only one instance. There are a hundred such chances in every city. Even in the smallest town they are not impossible to find.

There are many basements in the downtown districts of every city which solicitors might turn into profitable business by prevailing upon the owners to turn them into good renting property, and showing them how it can be done.

The writer has many more schemes and plans, some which he would like to take up here, but lack of space prevents.

It may be that a little later on he will have the opportunity to offer readers a few more suggestions along these lines.



Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Boys, I don't believe some of you are "in right" on this soliciting game.

You haven't the right idea of following a lead to the limit.

You don't use your head.

Some of you go chasing around after business when it's right under your nose.

Others there are among you who know where the business is to be had, but you don't go far enough to land the contract.

Take Jones, for example, over on the north side.

He's a hard, conscientious worker, but he does a big heap of unnecessary and unproductive labor.

He spends valuable time calling on people who are not the best of prospects and of necessity neglects some of the most likely ones.

Not because he doesn't know any better, but for the simple reason that he doesn't stop to think or plan ahead each day's programme.

New homes have been completed in his territory without him having seen the architect or contractor.

These are good prospects which should have never been overlooked.

Then there's Sinclair, who has the Sixth ward under his wing.

He's another good solicitor who's a hustler from the word "go" and knows where and when to get after business and usually makes a good showing.

But he seems to fall short when it comes to certain problems.

He knows enough to see every contractor building in his ward, and he generally obtains good business from them, now and then.

Last week, however, he fell down in signing up several new buildings.

I took the trouble to inquire of him, "why this happened."

"Could not interest the contractor," was his only excuse.

Now, boys, if you can not induce the contractor to place his "John Hancock" to the dotted line, do like that man Eddy did, who left us last week to become contract agent for an electric plant in ——.

He never stopped at the contractors—not much.

He tackled the owners of the building and has been able to show results from nine out of ten buildings put up in his territory.

That's what I call good work.

Now each and every one of you gentlemen can show similar results—and I want to see you touch the ninety-nine out of a hundred mark.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

One of the world's greatest harnessing feats outside of mighty Niagara was recently accomplished at Necaxa Falls,

Mexico, by the Mexican Light and Power Company.

After a big investment this company is now generating at Necaxa Falls electric current which courses its way through two hundred miles of wild territory, supplying an unlimited supply of electric power to Mexico City and El Oro.

In no other instance has electric current ever been successfully carried over so many miles of transmission lines from a single central station.

R. F. Hayward, general manager of this company, was formerly with the Utah Light and Railway Company, of Salt Lake City. He is well known for his enterprise and ability and stands very high with the people of the city of Mexico.

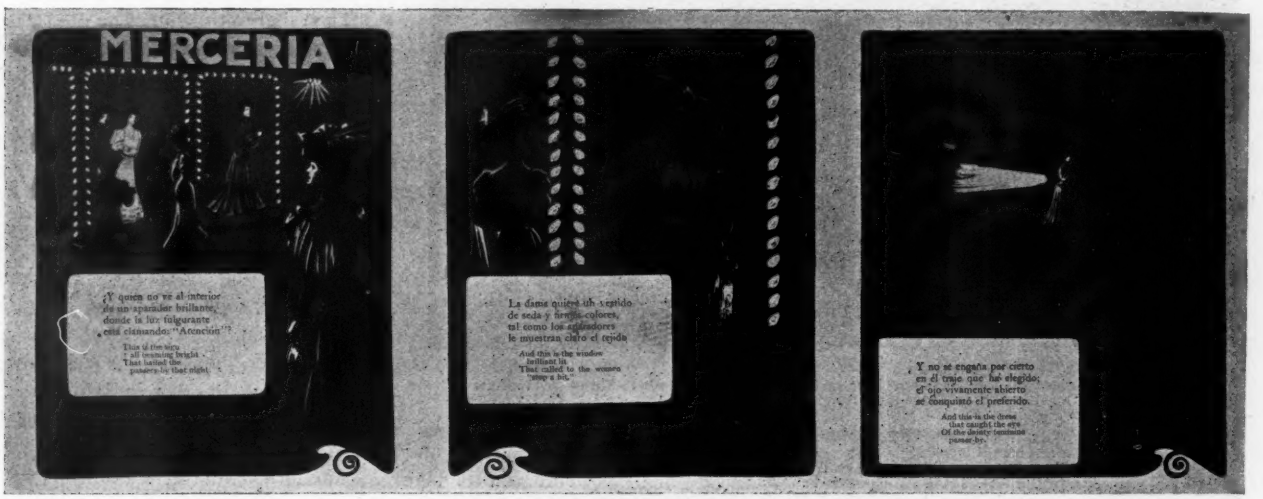
This progressive company's gross earnings for 1906 reached over $4,000,000, but the management was not at all satisfied, so it decided, after a practical and logical view of the situation, to organize a complete new-business department.

It has arranged for a very forceful system of advertising to back up this department, which will educate the people to the uses of electric current in the home, and demonstrate and convince merchants and business men of the benefits and economy of electric light, and the usefulness and value of the electric sign.

It has made arrangements with a large advertising concern in the United States for two distinct and carefully planned direct-by-mail advertising compaigns to cover a period of one year, one campaign or service to go to residences and the other to stores and business places.

Its resident advertising service consists of one piece of advertising each month, either a bulletin, booklet, folder or mailing card to be distributed to residents.

Its store service consists of three pieces each month—one bulletin, one folder and one mailing card, which are sent out ten days apart.



A folder entitled: "A Clean Cut Sale by Electric Light," which is to be sent out to merchants by the Mexican Light and Power Company. It is well written and well printed, and can not fail to impress merchants. To get the sense of the folder read the English verses from left to right across the two pages.

The condition of affairs in Mexico are radically different from those found in any other part of this country. The housewives in their country have a plentiful supply of servants, and nearly all of the domestic work, excepting sewing, is performed by hired help, so you can readily see that one of the greatest arguments in favor of electricity for domestic uses counts for naught —that of the saving in time, labor and annoyance. But the arguments of convenience, cleanliness and safety are emphasized all the more thoroughly.

Cooking and heating in Mexico is done almost entirely by means of charcoal and wood, so the advertising is written to show the housewife how electric cooking will eliminate the excessive dirt, smudge and heat.

The only other method of lighting, outside of electricity, is the ancient candle or the smoky oil lamp.

This, in one way, makes it the more difficult to introduce in such a community a new method of lighting so far in advance of their present means of illumination as electricity is.

It is natural for the people to be a little timid or backward in adopting it, as is always the case when some new and more efficient material or method is launched upon the market.

While Mexico City can be said to be one of the best lighted cities in the country from a municipal standpoint, it has been the custom of the merchants to light up their stores and windows by means of an inefficient oil lamp, and when closing the store at night to pull down heavy iron shutters, thus shutting their display from the public's gaze during the evening hours. So you can easily see what back numbers the merchants really were, and what past and forgotten methods the Mexican Light

A few newspaper advertisements of the Mexican Light and Power Company, placed in the *Mexican Herald*, an English paper published in Mexico City. Few central stations in America can boast of any better newspaper advertising. The company also uses Mexican newspapers extensively.

and Power Company has had to run up against, and what an impossible task it would have been for solicitors to interest these merchants in electricity for store, show-window lighting or electric signs without the aid of good, strong, logical postals are followed up to good advantage by a large, well-drilled corps of solicitors.

The company, in order to enthuse and educate its solicitors with the work it is doing, and to instruct them as to the most efficient methods of selling current and ideas of men who have attained great success in central station advertising.

The letters also pointed out that the success of the advertising rested upon them, and went on to show that now was the time for them to "make hay" and

Este es el premio logrado
al vendedor diligente
por tener iluminado
con luz que atrae a la gente.
And this is the paycheck
Out of which
She drew the coin
For that costume rich.
He aquí la gran fama
del agente más preciso
la luz eléctrica hizo
vender la tela a la dama.
And this is the courteous
clerk who showed
That dress 'mouth pure-color
and that glowed.
La caja marca cincuenta
con entera claridad,
la venta que ha sido hecha
por la Electricidad.
And this is the record
in black and white
Of a cleancut sale
by electric light.

advertising to pave the way, to back them up, or to educate the people to the right way of thinking, so that they became actually anxious to talk the matter over with the company's solicitors.

The advertising for both the resident and store service is being gotten out in such an attractive manner that it is the best ever issued in that country and is eagerly sought after, and never fails to receive careful perusal.

Its electrical bulletins compare in every respect to any sent out in America, but they are unlike our bulletins in that they cover only the household uses of electricity —special bulletins being gotten out to push business places, store and window lighting and electric signs.

Its resident bulletins consist of sixteen pages, handsomely printed in three colors and well illustrated throughout.

On account of mixed Spanish and English inhabitants, the Mexican Light and Power Company has each piece of advertising printed in both Spanish and English, the Spanish being in larger type than the English on the folders and mailing cards, and in the bulletins the two languages are on opposite pages.

Its store and sign booklets, and both its resident and store folders and mailing cards are all printed in two or three colors, suggestively and attractively designed, and the best of stock is used.

The return postal card is brought into use in every piece of advertising except the mailing cards, and inquiries from these landing contracts, had a series of letters gotten up to send to each solicitor at short intervals. These letters called attention to how the company was aiding them by

An attractive folder of the Mexican Light and Power Company of Mexico City, Mexico, the cover of which is printed in three colors on purple paper. It is one of the handsomest folders we have ever had the pleasure of seeing.

means of direct-by-mail advertising, and urged them to read and study carefully every piece of literature sent out, thus obtaining, for use in their solicitation, the show what they were worth to the company.

The company also sets the example for electric sign users by placing a large sign on the roof of its office, and once or twice a week lighting up its entire building with an elaborate electrical display.

Well illustrated newspaper advertisements also form part of their campaign, and we feel safe in saying that this progressive Mexican central station will revolutionize that somewhat backward country, and bring it up to date by this greatest agent of progress—electricity.

We congratulate them on their new-business department, and hope that the splendid example this progressive company is setting may prove an incentive to other companies to get out and surmount difficulties and "get the business."

The International Independent Telephone Association of America.

The annual convention of the International Independent Telephone Association of America will be held at the Auditorium Hotel, Chicago, Ill., June 4, 5 and 6. The advisory board, consisting of the presidents of affiliated associations, will meet at the Auditorium Hotel on June 3, the day before the convention opens, at 10.30 A. M. Special committees will also meet at the same time and place. The convention proper will be called to order June 4 at 2.30 P. M. The morning and afternoon sessions of the following days will be from 10 A. M. to 12.30 P. M., and from 2 to 4 P. M., respectively.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Western Electric Distributing Centre.

For several years past the Western Electric Company has maintained a sales office in Pittsburg, the territory embracing western Pennsylvania and West Virginia. The growth of the business in this part of the country has been steady, and the demand for a supply stock at this point became imperative, hence the company's decision to make Pittsburg one of its distributing centres.

A plot of ground of 26,000 square feet, on the Allegheny side of the river, was purchased last fall, and a five-story warehouse and office building has been erected thereon. The building is of the mill type of construction, and is equipped with electric elevator service, automatic sprinklers, and heated by natural gas. It represents the most advanced ideas in warehouse construction, affording fine facilities for the handling of goods. The company has a private siding from the Baltimore & Ohio Railroad running into the premises, and is therefore enabled to make large savings through concentration of goods for inbound shipment. The location is an admirable one from every point of view, it being but six minutes' ride from the heart of the business district, and within a few blocks of the principal freight and express terminals.

THE WESTERN ELECTRIC COMPANY'S NEW PITTSBURG FACTORY.

The company will carry a large and complete line of electric and telephone supplies for immediate shipment, and with the present strong position which it has attained in the Pittsburg district, its business seems destined to be materially developed and increased.

The interesting part of the story is the remarkable speed with which the building was erected and the novel methods employed. It became necessary, for various reasons, to get into a new building as soon as possible, as it was impossible to secure an extension of the lease at Shadyside, the former site of the house, after February 1. Three months was the time allotted, which made the task seem almost impossible, but when all the resources of the company were brought into play it was actually accomplished. Possession of the property was not obtained until October 5, 1906, but in the meantime plans for the building had been drafted under the direction of their plant engineer, and a contract signed with Chicago builders, so that by October 7 the work of razing the old buildings was begun. Work was then pushed day and night, a considerable part of the time three shifts of eight hours each being employed, the night work being made possible by artificial lights.

On November 22, a large circus tent 130 by 100 feet was raised, and from that time work was continued without interruption on account of the weather, the tent being moved up from story to story until the roof was completed. The roof was on and the building enclosed by January 1, 1907, and the moving of the stock from the Shadyside plant was begun. This consumed a period of thirty days, by the end of which time the interior work on the building had been practically completed, so that it was possible to move the offices on February 1.

A description of the new Pittsburg house at this time would be incomplete without reference to the flood which visited the city between March 13 and 17. The location of the warehouse so close to the Alleghany river placed it inside the bounds of the flooded district, which covered an area of many square miles. The site of the building is, however, at an elevation relatively higher than any other property fronting on the Alleghany, and in designing the building, the river's past record for floods was studied carefully. In order to avoid possible damage from that source no cellar was built, and the first floor, which is of concrete, was raised to a point one foot above the high-water record of the past fifty years, a precaution which seemed to preclude the possibility of a flood ever reaching this floor. But 1907 was destined to see all flood records broken, and the turbulent Alleghany, swollen by spring freshets, broke its bounds, and inside of thirty-six hours showed a rise at Pittsburg of approximately twenty-eight feet.

In common with other business houses within a radius of three blocks of the river, the Western Electric building was surrounded by water early on March 14, so that it was necessary to pass to and from the building in a wagon. Shipments were made up to that afternoon, by which time the water had reached a depth of over four feet around the building and prevented the exodus of those employés who had remained. At this time the water was still a foot below the first floor, but as the previous high-water mark had been reached and the rise still continued, all stock on the first floor which could be injured by water was removed to the floors above. The carpenters in the shop were then pressed into service to build a boat, by means of which the remaining employés were carried out in safety a distance of two blocks to dry land, and a force of men located in the building for the night. This home-made boat, which was constructed in less than an hour, was made watertight by the use of jute and W. E. compound, and was appropriately christened the "Carrie Mohr" by the breaking of a bottle of transmitter disinfectant on her bow.

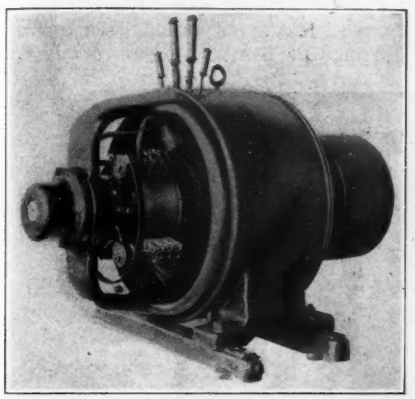
The water continued to rise on the night of the 14th, and at midnight reached a point twenty inches above the first floor level. This was equivalent to a mark of 36.2 feet on the Government scale, upon which eight feet is the normal mark. This height had never before been reached, and the damage to property in Pittsburg has been estimated at as high as $50,000,000. On the morning of March 15 the flood dropped rapidly, so that with the aid of fire hose it was but short work to clean the first floor in the building and the cable yard, which is also elevated above the street and property adjoining.

Business was resumed with a loss of less than a day's time. The property suf-

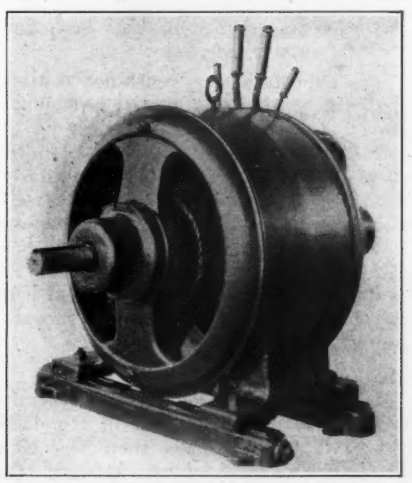
fered no damage except for a slight settling of the concrete floor in several spots; neither was there any considerable damage to the stock.

Allis-Chalmers Type "K" Direct-Current Motors and Generators.

The Allis-Chalmers Company, Milwaukee, Wis., has placed on the market a new line of direct-current motors and generators designated as type "K," especially designed to meet the mechanical and electrical requirements of direct-current machines that can be adapted to modern conditions of shop work. The demand for a wide variation in speed by shunt-field control in motors with occasional heavy overloads at any speed has called for material improvement in commutating qualities.



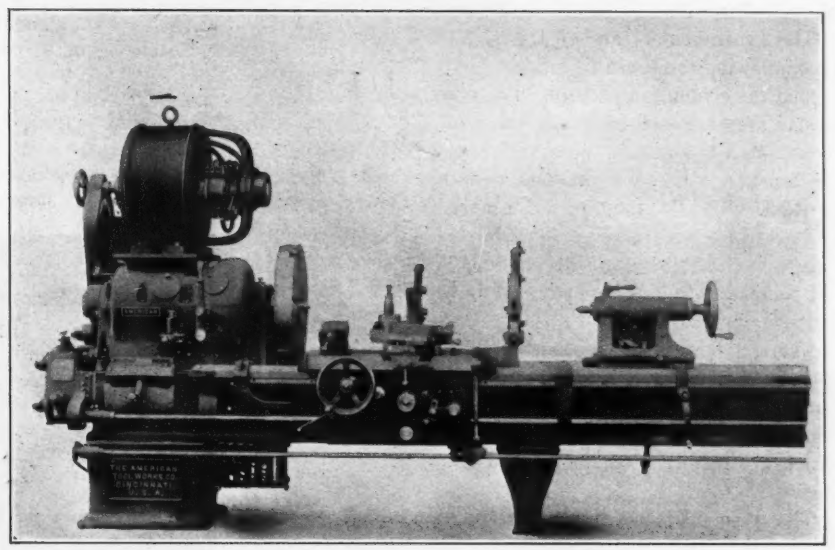
COMMUTATOR END, TYPE K MOTOR.



PULLEY END, TYPE K MOTOR.

The new type "K" direct-current motor is equally well adapted to belt drive at constant speed and continuous service, or gear drive, variable speed and intermittent service.

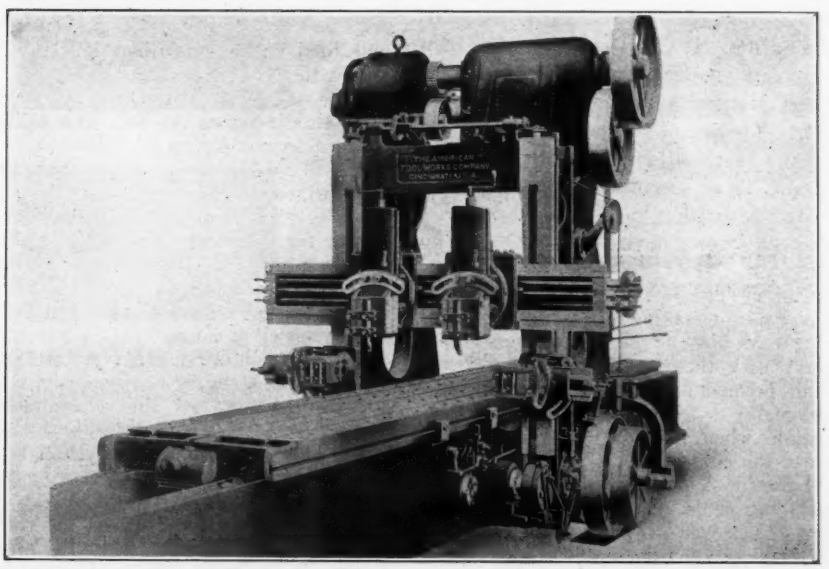
The external appearance is similar to the types "N" and "B" motors heretofore manufactured by the company, but the construction differs in many important details, and, in fact, represents a new design throughout. The changes, both electrical and mechanical, are the result of many years' experience in the construction of motors for industrial purposes.



TYPE K MOTOR-DRIVING LATHE THROUGH PATENT GEARED HEAD.

The cylindrical field magnet yoke is of open hearth steel, machined on each end to receive the housings that carry the bearings. The housings are held in place by through bolts, and on four-pole machines can be rotated ninety degrees or 180 degrees to allow for side wall or ceiling mounting. Bipolar machines can be arranged for floor or ceiling mounting. The yoke is machined on the inside cylindrical surface, and the poles are fastened to it by countersunk filister-head cap screws. The pole cores are of open hearth steel, circular in cross-section. These cores are machined on one end to fit the inner surface of the cylindrical yoke, and on the other to receive the pole-shoes. The pole-shoes are built up of annealed steel punchings, and are fastened to the poles by flat-head machine screws.

The armature cores are built up of sheet steel punchings, the laminations being keyed to the shaft. In building up the core the laminations are separated at intervals so as to form radial ducts. The punchings are firmly clamped between cast-iron end heads, which serve also as supports for the ends of the armature



TYPE K MOTOR-DRIVING PLANER, WITH CONSTANT SPEED RETURN.

coils. The armature coils are form wound and interchangeable. The commutator is of large diameter and ample wearing depth. Clamping rings hold the bars firmly, and the whole construction is such as to secure a perfect cylindrical surface free from high or low bars.

The bearings are large, lubricated by oil rings which rest on the shaft and dip into oil wells beneath.

The brush-holders are of the reaction type, allowing the brush to follow the surface of the commutator freely. The brush studs are fastened to a rocker arm mounted on the bearing housing, allowing the brushes to be set at the best running position. The brushes are of graphite, and are connected to the holders by flexible copper shunts, so that the current is not compelled to pass through any sliding contacts.

The standard type "K" motor is made open at the ends, but may be constructed semi-enclosed or totally enclosed by the addition of suitable metal enclosing covers which are readily fitted to the end housings.

The type "K" machines operate exceptionally well as generators. The generators are compound wound and will deliver any current from zero to full rated output without sparking and without shifting brushes.

Ward Leonard Push-Button Automatic Motor Starters.

The Ward Leonard Electric Company, Bronxville, N. Y., has designed a new automatic motor starter, embodying the latest features and improvements in the art. This line of starter is best described by the specifications to which they conform. These specifications are published in full herewith:

SPECIFICATIONS COVERING SELF-STARTING PANEL.

FIRST—The panel shall start the motor on the making of a circuit by means of a push-button, the push-button not to carry over three amperes. This circuit shall become deenergized as soon as the automatic switch closes, so that the push-button, when released, does not have to break the circuit.

SECOND—The motor shall stop when a push-button is pushed, breaking a circuit of not over one-tenth of an ampere.

THIRD—When the motor is not running there shall be absolutely no power absorbed by the self-starting panel or by the motor.

FOURTH—The self-starting panel shall consist of:

(A) Double-pole knife switch and two fuses.

(B) An automatic switch which shall be a self-closing switch, to establish the main line circuit. It will close when energized by closing a push-button, and will automatically open the circuit upon overload, upon "no-voltage" or when the "stop" push-button is operated.

(C) Automatic resistance-controlling device.

(D) Resistance.

(E) Overload device.

(A) *Knife Switch and Fuses.*

The knife switch and fuses shall be of the National Electric Code standard and shall be rugged and strong in construction.

(B) *Automatic Switch.*

1.—The automatic switch shall be of the laminated double-break type.

2.—There shall be an auxiliary metal-to-metal break for shunting the laminæ and final carbon-on-carbon break. The automatic circuit-breaker switch shall be capable of automatically breaking a dead short-circuit across the full line voltage, without serious injury to itself.

3.—The self-closing switch shall have no small, easily breakable, flimsy parts for breaking the circuit of the lifting magnet, or for inserting a resistance in series with this magnet. It shall have a lifting magnet and a holding magnet, the lifting magnet being automatically short-circuited when the switch closes.

4.—The holding magnet circuit shall be capable of standing continuously, without injury, the full line electromotive force.

5.—The self-closing switch shall be so interlocked with the resistance-controlling element of the self-starter that it can not be automatically closed unless the resistance-controlling element is in the all-resistance-in position.

6.—The self-closing switch magnet circuit shall not take more than ten watts when the switch is in its closed position.

(C) *Automatic Resistance-Controlling Device.*

The automatic resistance-controlling device shall consist of:

(a) Controlling magnets with switch.

(b) Resistance-controlling stationary contacts and movable contacts.

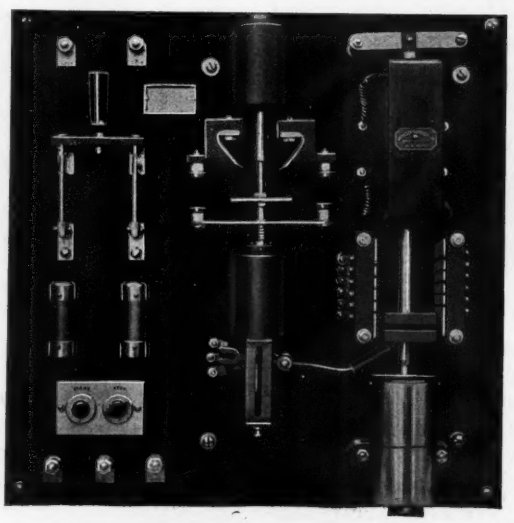
(c) Dashpot.

(a) *Controlling Magnets with Switch.*

1.—The controlling magnets shall consist of a lifting magnet and a holding magnet, and at the short-circuit position of the resistance-controlling contacts, the lifting magnet shall be automatically open-circuited.

2.—The holding magnet and its resistance shall not absorb more than ten watts after the motor has been started and is operating normally.

3.—The lifting magnet shall have such a capacity that it will be possible to start the motor at least once each minute for an hour, taking ten seconds each time for starting the motor, without in any way injuring or materially altering the operation of the magnet.



PUSH-BUTTON AUTOMATIC MOTOR STARTING PANEL.

(b) *Resistance-Controlling Stationary Contacts, Etc.*

1.—The stationary resistance contacts shall be readily removable and renewable from the face of the controller.

2.—The movable contacts (sliding shoes) of the resistance-controlling device shall be easily renewable and of the self-aligning, self-adjusting type, and be able to ride over any projection standing one-sixteenth inch above the surface of the contact segments. There shall be at least two independent shoes for each movable contact.

(c) *Dashpot.*

1.—The dashpot shall be a vacuum dashpot, with sufficient oil in the dashpot so that at all times there will be a perfectly air-tight joint between the plunger and the dashpot walls.

2.—The condition of the vacuum shall not be dependent in any way on felt or leather washers.

(D) *Resistance.*

1.—Resistance material, when cold, shall stand without injury or alteration, a current of fifty per cent in excess of the full load motor current for one minute,

or 100 per cent in excess of the full load motor current for twenty seconds.

2.—The resistive conductor shall be of a metallic alloy of high fusing point and with a temperature coefficient not greater than that of ordinary German silver. Resistance materials which rust, or whose resistance alters greatly when heated, such as copper, iron or carbon, will not be acceptable.

3.—The resistive conductor shall be surrounded by, and mechanically held in position by, a high-class insulating material, so that in case the conductor be melted by excessive current or broken by mechanical strain, the conductor can not move.

4.—The resistance material shall be so arranged that in case of burn-out it shall be impossible for flames to be developed or for molten metal to be ejected from the casing.

(E) *Overload Device.*

The overload device shall operate by breaking the circuit or the holding magnet of the main line solenoid switch, thereby positively causing the switch to open. Overload devices which operate by short-circuiting the no-voltage magnet will not be accepted.

Window Lighting.

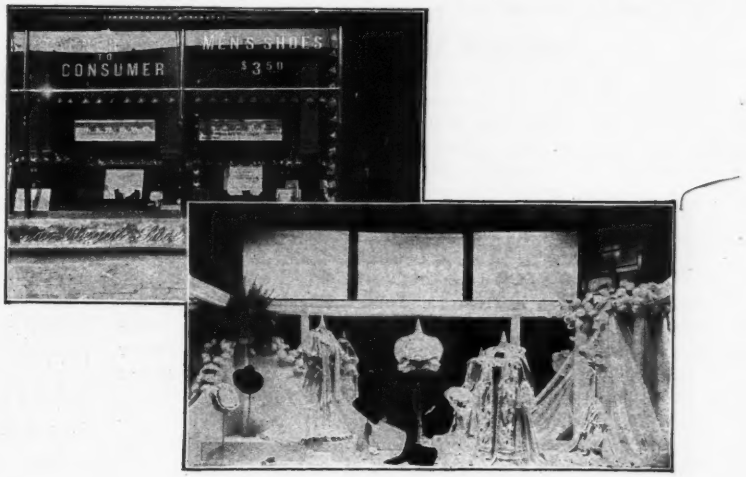
Window lighting may be divided into two classes. Where the lights themselves are the attraction, and where lights are used to properly illuminate the goods displayed. In the first class come saloons and places where no goods are displayed and the lights simply are used for attracting attention. Unfortunately, this method is often used where the result desired is to show the goods, as, for example, where rows of bare incandescent and electric lamps form the border of a display window. Owing to their being in the line of vision, they fail in producing proper results.

A famous French scientist charges Americans with "caring as little for their eyes as they do for their stomachs." That there is a measure of truth in this statement can not be denied.

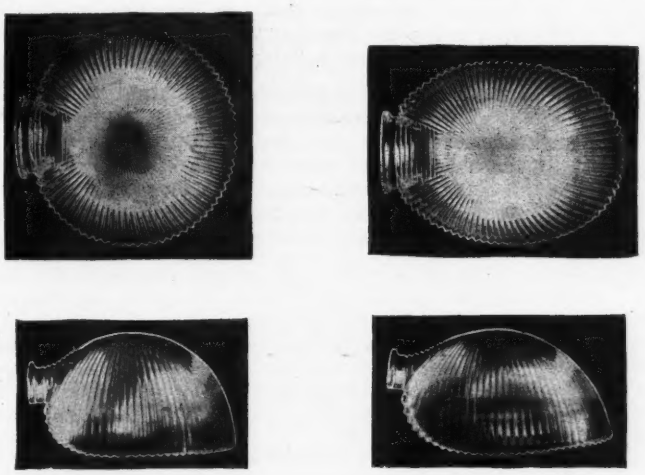
People looking in the window often make the statement that the light is "hard on the eyes," which simply means that the source of light is too intense to be comfortably or safely looked at. For a window where goods are shown, the light should be entirely hidden and at the same time concentrated strongly on the goods displayed.

The Holophane system of lighting is particularly adaptable to window lighting. The accompanying illustrations show two forms of Holophane reflectors for window lighting. They can be used advantageously where the lights are placed either horizontally or vertically along the frames of the window. They have the advantage of not only concentrating the light strongly on the goods but also protecting the eyes from the glare of the filament, thus allowing the use of clear lamps. At the same time enough light passes through the prisms to make a pleasing appearance and add to the advertising value of the lights. Where it is desired to hide the lights entirely they should be placed just above the top of the glass of the window. The Holophane reflectors will then concentrate the light and direct it downward, allowing just sufficient illumination for the ceiling. The reflectors can be slanted so as to illuminate a window of any depth or height. In case they are not placed higher than the top glass, a black band should be painted on the glass of sufficient depth to hide the reflectors from observation from the street.

A novel effect may be obtained by forming any desired sign in the black band, the light shining through the Holophane reflectors, making the letters stand out distinctly.



THE HOLOPHANE SYSTEM OF LIGHTING.



TOP AND SIDE VIEWS OF HOLOPHANE WINDOW REFLECTORS.

Central & South American Telegraph Company.

A special meeting of the stockholders of the Central & South American Telegraph Company will be held on May 14 for the purpose of voting upon a proposition to increase the capital stock from $8,000,000 to $12,000,000. It is proposed to issue $2,000,000 of the new stock, as a twenty-five per cent stock dividend, representing the capitalization of earnings expended for additions and improvements. The balance of the authorized issue will be reserved for future use in connection with expenditures for the new cable between New York and Colon, and other extensions and betterments.

Current Electrical News

DOMESTIC AND EXPORT.

BOSTON ELEVATED RAILWAY COMPANY—At a special meeting of the Boston Elevated Company it was voted to authorize an issue of $5,800,000 bonds and $8,000,000 stock. The stock will be offered to stockholders at a price to be determined by the railroad commissioners. The proceeds of the stock will be used for paying for the construction of the Cambridge subway, while the sale of the bonds will provide funds for power additions, new equipment and the Forest Hill extension.

MORE COLORADO POWER PLANS—A project has been started in Boulder, Col., for a hydroelectric plant, known as the Boulder Hydroelectric Company. The incorporators are James Cowie, William Babcock and Norton Montgomery. The plan is to take water from Boulder creek at three different points, securing altogether about 15,000 horse-power. A plan for the lighting of Garfield county and adjoining territory by power from the Colorado river is projected by a new company, at the head of which is Charles Hamblin, of Indianapolis. The scheme is to divert part of the Colorado river from a point near its junction with the Grand river through a tunnel to the proposed plant of the new company a mile distant. It is the intention in this way to furnish the power for the lighting and operating of the machinery in the placer mines along the Colorado, Grand and Green rivers. An application has been filed with the state engineer by Mr. Hamblin for permission to divert 6,000 second-feet of water from the Colorado river for this purpose. It is expected that work will be begun on the proposed plant immediately upon the granting of the application.

CHARTER GRANTED TO OKLAHOMA ELECTRIC LINE—The territorial secretary has granted a charter to the El Reno, Oklahoma City & Shawnee railroad, standard gauge, with headquarters at Oklahoma City, Chicago and New York. The road is capitalized at $2,500,000. The incorporators are G. N. Martin, of Chicago; S. P. McIntyre, of New York, and Elmer E. Houghton, Nick M. Ellis and John H. Wright, of Oklahoma City. The charter application shows that the purpose of the company is to construct an electric line from El Reno *via* Oklahoma City to Shawnee, with a branch line to Norman. A corps of surveyors is surveying the line between Oklahoma City and Shawnee, and it is expected that this work will be completed within a few weeks. Actual construction will follow as soon as possible. It is believed that the company backing the enterprise will arrange to purchase the Oklahoma Interurban Traction Company's line, now operating from Oklahoma City to East Capitol Hill.

CONNECTICUT POWER PLANS—Plans and specifications that have been in the hands of contractors for some time for the power station to be built by the Uncas Power Company, of Norwich, Ct., about 4,000 feet northwest of Scotland station on the Shetucket river near Sheep Rock cut, have been returned to the company with bids for the erection of the dam and power-house and the contract will be immediately awarded. The contract requires that the power-house be ready for the installation of machinery by August 1, 1907, and the dam ready to close not later than October 1. Contracts were signed with the General Electric Company some time ago for the electrical plant and require that the plant be ready for operation not later than October 15. A contract has been signed with S. Morgan Smith Company, of York, Pa., for the water-wheels, etc., to be complete and ready for use October 15. Each of the above-mentioned contracts carries a penalty of $25 per day after specified time. The dam is to be 480 feet long and rising thirty-two feet above solid rock bottom, which is to be found four feet below the river bed. It will be modern in design, built in circular or arch form. The pond will recede over four miles from the dam and for about 1,800 feet will rest against the railroad tracks, which must be raised seven feet to avoid overflow and to enable the power company to use the full capacity of its plant.

PERSONAL MENTION.

MR. EDGAR VAN ETTEN, long identified with Vanderbilt interests and formerly general manager of the New York Central, has resigned his vice-presidency of the Boston & Albany Railroad to assume the presidency of the Long Acre Electric Light and Power Company.

MR. ED. MAIN, who has resigned from his position as city engineer of Rockford, Ill., has accepted the position of chief engineer of the Rockford & Interurban Railway Company. He will have charge of the roadbed and overhead work, besides the construction of extensions and new lines.

MR. JOHN SHIELDS, for a number of years superintendent of the Fourteenth street line of the Detroit (Mich.) United Railways, has been appointed superintendent of the Bay City and Saginaw (Mich.) street railways and the interurban line connecting them, for the Saginaw Valley Traction Company.

MR. CHARLES R. HUNTLEY has been elected president of the Buffalo (N. Y.) General Electric Company to succeed the late Daniel O'Day. Mr. Huntley has been serving the company in the capacity of vice-president and general manager for many years and is an able and energetic executive.

MR. C. C. LINES, superintendent of track and lines, Rockford & Interurban Railway Company, was presented with a handsome gold watch by his associates on April 30. Mr. Lines worked his way up from the position of motorman, and has been with the company for eleven years. He has given up his local work at Rockford to take charge of the construction of the Beloit line which the company is now building.

PROFESSOR ALEXANDER GRAHAM BELL received the degree of Doctor of Science from Oxford University, England, on Thursday, May 2, in recognition of his efforts to teach the deaf and dumb to speak and for his invention of the telephone. The presentation was made by the dean of the faculty of science, Professor A. E. H. Love. The same evening Dr. Bell was given a dinner in London by the Institution of Electrical Engineers.

MR. W. R. GOUDY, for sixteen years with the Sioux City Gas and Electric Company, of Sioux City, Iowa, has been selected by the United Gas Improvement Company, of Philadelphia, to represent it in the Syracuse Lighting Company, of which it has secured control. He will be elected secretary. Louis L. Waters, the present secretary of the Syracuse Lighting Company, will resign. The Sioux City plant is controlled by the United Gas Improvement Company.

MR. MORRIS W. MEAD is now affiliated with the H. W. Johns-Manville Company as manager of its electrical and insulating departments. Mr. Mead's twenty-four years' experience as superintendent of the Bureau of Electricity for the city of Pittsburg and his later connection with the National Cable and Wire Company as general sales manager has made him thoroughly acquainted with the practical questions of electrical construction and contract work.

DR. GEORGE OTIS SMITH has been appointed by President Roosevelt director of the United States Geological Survey, succeeding Charles D. Walcott, who takes up his duties as secretary of the Smithsonian Institution. Dr. Smith was born in Aristook county, Maine, thirty-six years ago. He is a graduate (Ph.D.) of the Johns Hopkins University. He has been connected with the Survey since soon after his graduation (1896) and has done a great deal of important work.

MR. CLARENCE P. HAYDEN, superintendent of the Exeter, N. H. lines of the New Hampshire Electric Railways, has been appointed division superintendent, *vice* Robert S. Dunbar, resigned. His division embraces the Haverhill, Lawrence and Salem lines, and

Canobie Lake park. He has assumed his duties with headquarters at the Salem station, and for the present will superintend the eastern and western divisions of the system, no selection having yet been made by the company officials for the eastern division position.

MR. GEORGE H. DANIELS, for the last two years at the head of the advertising bureau of the New York Central & Hudson River Railroad, has retired from active service. He will be succeeded by John C. Hammond, who has acted as press representative of the New York Central for several months. Mr. Daniels began railroading as a rodman, at the age of 15, in the engineering corps of the Chicago & Pacific Railroad. He became freight and passenger agent of the railroad in 1872. He was later general ticket agent of the Wabash and finally chairman of the Chicago eastbound passenger committee. In 1889 he was appointed general passenger agent of the New York Central. He put into effect many novel ideas for advertising the road, one of which was the establishment of the *Four Track News*, which he originated. Mr. Daniels is one of the most widely known railroad officials in the world, and his courtliness and geniality has won him a host of devoted friends. He has been anxious to retire for over a year, the death of his wife having affected him deeply. A wide circle of friends and acquaintances, particularly in the newspaper and advertising fraternity, will wish "Uncle George" much joy and peace in his well-earned retirement.

OBITUARY NOTES.

MR. WILLIAM J. McKINNIE, a well-known Cleveland business man, died on Sunday, April 28, at his home, 2803 Prospect avenue. He was seventy-six years old and had lived a life of great usefulness. The Cleveland *Plaindealer* says: "He was one of the founders and the first president of the Cleveland Telephone Company, founder of what became the Cleveland Electric Lighting Company, director in the New York, Pennsylvania & Ohio Railroad Company and the Pittsburg & Toledo Railroad Company, a member of the firm of Andrews, Hitchcock & Company, coal dealers, and president of the Playford Stoker Company, which no longer exists. He held as many more positions of minor importance."

MR. PERRIN TRUMAN KELLOGG died at his home in Whitefield, N. H., Monday, April 22. He was born at Worcester, Vt., October 27, 1863, educated at Montpelier academy and Dartmouth college, and after studying law at Montpelier was admitted to the bar in New Hampshire. Mr. Kellogg was the organizer of the Whitefield Water Company, the Whitefield Manufacturing Company and the Gorham Electric Light Company, of which he was a director and stockholder. He was also a stockholder of the Whitefield Electric Light Company and a stockholder and director of the Maine Condensed Milk Company. He organized, and at the time of his death was president of, the Lancaster-Jefferson Electric Light Company, and was one of the owners of the "Molley Falls," waterpower.

MR. NATHANIEL PARKS, eighty-two years old, a pioneer in electric experiments and inventions, says the New York *Sun*, died at his home in Deansboro, Oneida county, N. Y., Tuesday, April 30. When a young man Mr. Parks became interested in the subject of electricity, and devoted much time to studying and experimenting with this element with a view to using it for mechanical and commercial purposes. In company with Daniel B. Goodwin, of Waterville, N. Y., he sank several miles of wires in the Shenango Canal near Bouckville, and to these wires attached telegraphic instruments for the purpose of testing the practicability of a water cable. The information thus gathered was increased by experiments made on a more extended scale in the Harlem river by Mr. Parks, in company with Cyrus W. Field, who laid the first Atlantic cable in 1858. Mr. Parks had an important part in perfecting the arrangements for laying this cable and transmitted some of the first messages over it. He devised many electrical appliances, but failed to benefit in a financial way from his inventions.

ELECTRICAL SECURITIES.

As time runs on there appears on the market's horizon a brighter aspect, and it is evident that a more hopeful feeling prevails. This is, however, a condition always engendered by a rising market. There has been a real improvement, recently, the continued and unbroken ease in money rates being a potent factor in stimulating this improvement. Less apprehension is felt, nowadays, by Western interests concerning the ability of their own financial institutions to meet seasonable demands, and New York has lost some of its prestige as the leading financial centre of the country. There has been some dullness in the market, pending the consumers' determination to stay purchasing until concessions are made for raw material. So far there has not been much indication of a rush on the part of the producers to force the market, particularly in those metals upon which the electrical interests are dependent. Indeed, there is danger, that in waiting too long, there may come a heavy demand for raw materials all along the line, resulting possibly in an advance in price. This, however, is not warranted, in the face of the high prices prevailing, and the quantity of material which must inevitably have been stored during the lull against the orders which must come, probably sooner than later.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MAY 4.

New York:	*Closing.*
Allis-Chalmers common	11⅞
Allis-Chalmers preferred	32¼
Brooklyn Rapid Transit	61¼
Consolidated Gas	133
General Electric	148¼
Interborough-Metropolitan common	25½
Interborough-Metropolitan preferred	60
Kings County Electric	126
Mackay Companies (Postal Telegraph and Cables) common (ex-dividend)	70¾
Mackay Companies (Postal Telegraph and Cables) preferred (ex-dividend)	68½
Manhattan Elevated	139½
Metropolitan Street Railway	94
New York & New Jersey Telephone	114½
Western Union	82½
Westinghouse Manufacturing Company (ex-dividend)	143¾

Boston:	*Closing.*
American Telephone and Telegraph	124
Edison Electric Illuminating	202
Massachusetts Electric	56½
New England Telephone	119½
Western Telephone and Tele; aph preferred.	70

The Western Telephone and Telegraph Company has sold to Kidder, Peabody & Company $8,000,000 5 per cent two-year notes, dated May 1, 1907, in denominations of $1,000, $5,000 and $10,000. Interest is payable May and November. They are secured by $12,000,000 of Western Telephone and Telegraph collateral trust bonds due 1937. The Western Telephone and Telegraph Company earned for the year ended January 31, 1907, $1,800,000; interest on funded debt and taxes amounted to $500,000, leaving a balance applicable to interest on notes and dividends on the stock of $1,300,000.

The annual report of the New England Telephone and Telegraph Company is as follows: gross revenue, $9,312,999; operating expenses, $7,489,349; net, $1,823,650; dividends, $1,672,857, leaving a surplus of $150,793, as compared with $165,473 for the previous year.

Philadelphia:	*Closing.*
Electric Company of America	10
Electric Storage Battery common	52⅛
Electric Storage Battery preferred	52⅛
Philadelphia Electric	8¾
Philadelphia Rapid Transit	21¼
United Gas Improvement (ex-dividend)	92½

Chicago:	*Closing.*
Chicago Telephone	130
Chicago Edison Light	143
Metropolitan Elevated preferred	65
National Carbon common	70
National Carbon preferred	114⅞
Union Traction common	—
Union Traction preferred	—

The Metropolitan Elevated April daily average of passengers was 156,275, an increase of 18,798.

The South Side Elevated daily average number of passengers carried for April was 103,152, an increase of 7,396.

The Northwestern Elevated Company's daily average carriage of passengers during April was 90,134, an increase of 5,890.

The daily average passenger traffic of the Oak Park Elevated for April, including transfers, was 50,248, an increase of 1,227.

The Chicago Stock Exchange is arranging to list local traction deposit certificates to be traded in instead of the shares of the North and West Chicago and Union Traction companies.

ELECTRIC LIGHTING.

GRAND RAPIDS, WIS.—The proposition to purchase the electric lighting plant in this city has carried by a majority of about twenty votes.

WABASH, IND.—Jay Brown's manufacturing plant and electric light plant at North Manchester have been destroyed by fire. The loss is $20,000; insurance, $15,000.

CHARLOTTE, N. Y.—At a special election it was voted to bond the village for $18,000, the money to be used in repairing and enlarging the municipal electric light and water plants.

LA CROSSE, WIS.—The Wisconsin Light and Power Company, the competitive lighting company organized here two years ago, has sold its properties to the La Crosse Gas and Electric Company.

MORRISTOWN, N. J.—The United Electric Company is planning the erection of an entirely new $150,000 power plant, to be completed, if possible, within a year's time. The land to be used is a plot 125 feet by 300 feet.

HEMPSTEAD, TEX.—A modern electric light plant, to be installed and run under the ownership and management of a corporation, is proposed for Hempstead. Plans for the enterprise are yet in the elementary state.

RUTHERFORD, N. J.—The committee of fifteen appointed by Mayor Brinkerhoff, of Rutherford, to investigate the proposition to establish a municipal lighting plant, has reported against the scheme, as it would cost $216,000.

CHELSEA, MICH.—Ground has been broken for a substation for the Commonwealth Power Company, of Jackson. The plant is located on property adjoining the Detroit, Jackson & Chicago electric line, to which the power is to be furnished.

DAVENPORT, IOWA—The sum of $8,559.50 has been paid by the Independent Light and Power Company to Henry G. Schmidt for a tract of land in the western end of the city, on which is to be erected the new lighting plant of the company.

HOQUIAM, WASH.—The work of clearing the site for the new power plant to be built by the Gray's Harbor Railway and Light Company, has been started. This plant will furnish power and light for Hoquiam and Aberdeen and will be the best equipped in this part of the state.

STOCKTON, CAL.—Ground has been broken by the American River Electric Power Company for the erection of its new powerhouse on Banner Island. Nearly all of the machinery for the equipment of the plant is on the ground, and the remainder is on the way from the East. This plant will supply local customers, particularly the traction company.

KENOSHA, WIS.—The towns of Bristol and Salem are planning the installation of a $40,000 electric lighting plant to furnish electricity not only for the lighting of the streets of the two villages, but for use in the homes of farmers in the towns. The president of the new company is A. S. Higley. It is planned to have the plant in operation by September.

BLACK RIVER FALLS, WIS.—Work has been started on the water power plant on Black river. The entire contract has been let to a New York firm. The work is to be pushed along four lines of construction at the same time—the work on the dam proper, the flume, nearly two miles long; the power-house and the distributing line. Several hundred men will be employed.

NEWARK, N. J.—The Newark common council special committee on municipal lighting has given its approval to a plan for the establishment of a public electric lighting plant at the old Newark waterworks pumping station, in Belleville. City Counsel Nugent will prepare a resolution calling for a special election at which the citizens can vote upon the question of a $1,000,000 bond issue for this purpose.

FULTON, N. Y.—Plans and specifications are in course of preparation by the Fulton Light, Heat and Power Company's engineers for a substantial increase of the company's plant and capacity. The company recently added to its equipment, increasing its horsepower from 420 to about 900, but the demands for power continue to increase. The company has, therefore, decided to again more than double its capacity, the plans now under consideration aiming to provide for an increase of 1,000 or 1,200 horse-power.

NEW INCORPORATIONS.

GUTHRIE, OKLA.—Banner Telephone Company, Dover. $500. Directors: A. L. Mayes, L. D. Bond, Fred Schields, W. E. Swetzer.

HARRISBURG, PA.—The Columbia Bangor Power Company, of Portland. $225,000. Incorporators: William Bray, Milton Flory and David L. Emanuel.

PITTSBURG, PA.—Fort Pitt Light, Heat and Power Company, Turtle Creek. $10,000. Directors: B. S. Hare, M. R. Chubbuck, E. L. Van Dermast, Pittsburg.

MADISON, WIS.—The Century Telegraph Construction Company. A foreign corporation organized under the laws of New York. $500,000. Wisconsin agent, C. J. Chapin, Milwaukee. Capital represented in Wisconsin, $10,000.

SPRINGFIELD, ILL.—Peoria, Lincoln & Springfield Traction Company. To construct and operate a railway from Lincoln, Logan county, to Mackinaw, Tazewell county, Illinois. $400,000. Incorporators: C. Zilly, W. H. Burke, C. A. Wright.

MONTPELIER, VT.—The Jones & Lawson Power Company, of Springfield. For the purpose of furnishing electricity for light, heat and power. $48,000. Incorporators: C. A. Woolson, James Hartness, W. D. Woolson and Fred B. Gill, of Springfield.

SPRINGFIELD, ILL.—Chicago, Ottawa & Peoria Railway Company. To construct a railway from Chicago to Peoria and from Ottawa to Princeton, all in the state of Illinois. $500,000. Incorporators: H. E. Chubbuck, W. H. Carnahan, G. M. Mattis.

MADISON, WIS.—The Badger Mutual Telephone Company, Orange; $10,500; incorporators: G. B. Bailey, H. C. Abramson, H. J. Halberg and three others. The Liberty-Newton Telephone Company, Liberty; an amendment increasing its capital from $1,400 to $3,650.

MONTPELIER, VT.—Passumpsic Telephone Company. To operate in Essex, Orleans and Caledonia counties. $250,000. Incorporators: George H. Prouty, of Newport; John Rickaby, L. P. Slack and Edmund F. Taft, of St. Johnsbury, and Matt B. Jones, of Newton, Mass.

DILLON, MONT.—The Centennial Telephone Company. $20,000. Robert T. Boatman, president; A. B. Wakefield, vice-president; Pearl I. Smith, of Dillon, secretary and treasurer. The company will immediately begin the building of a line between Monida and Lakeview.

PITTSBURG, PA.—Mentor Street Railway Company, Elizabeth, Allegheny county. To build ten miles of road in Elizabeth and adjoining counties. $60,000. President, D. B. Negley, Pittsburg. Directors: R. L. Kern, J. K. Neagley, George McKain, N. F. Bicking, Pittsburg.

HARRISBURG, PA.—Perkiomen Valley Traction Company. To build a line from Collegeville to Schwenksville, a distance of six miles, connecting at Collegeville with the road from Philadelphia to Pottstown, which is to be extended to Reading. I. H. Bardman, president. $75,000.

ATLANTA, GA.—Articles of incorporation have been granted to the Georgia Electric Railroad Company, which proposes to build an extension of the Brookwood trolley line, north of Atlanta, to Buckhead, a distance of about four miles. This company is subsidiary to the Georgia Railway and Electric Company, and has the nominal capital of $10,000.

GUTHRIE, OKLA.—The Citizens' Telephone Company, of Driftwood; $3,500; incorporators: H. J. Kragh, J. W. Gass, John Angels, A. C. Hoefer, W. E. Barkley, W. H. Cloyd and S. C. Lambert. The Capron Telephone Company, of Capron; $7,000; incorporators: Fred J. Fash, W. D. Anderson, Joseph T. Fash, J. M. Daughhetee, Charles E. Curran, Conrad Schwartz, J. C. Walker and William Webb, all of Capron; E. U. Anderson, of Kiowa, Kan.

SPRINGFIELD, ILL.—St. Louis, Terre Haute & Quincy Traction Company. To construct a line from a point in Illinois opposite Terre Haute, Ind., through the counties of Adams, Pike, Scott, Greene, Macoupin, Sangamon, Montgomery, Shelby, Coles, Cumberland, Clark, Fayette, Bond and Madison, to Venice and Quincy, Ill. $25,000. Incorporators and first board of directors: Edward Yates, Pittsfield; Peter Chase, Decatur, Ill.; H. T. Wilson, Virden, Ill., and E. E. Barclay, Springfield, Ill.

LEGAL NOTES.

CONTRIBUTARY NEGLIGENCE IN ACCIDENT CASES—A volunteer who, having been warned of the danger of approaching a broken electric wire which he knows to be uninsulated and to carry a current for lighting purposes, and to have shocked another into insensibility, approaches the wire for the purpose of determining whether or not it is still alive, is held, in Carroll *vs.* Grande Ronde Electric Company (Or.) 6 L.R.A.(N.S.) 290, to be guilty of such negligence that no recovery can be had for his death, in case he places his hand within the danger zone, and a shock from the wire kills him.

RAILWAY COMPANY'S REPORTS—A report made to the claim agent of a street railway company by the conductor and motorman of an electric car, of an accident in which a passenger was injured, which was made pursuant to a standing rule of the company for the information of the claim agent, as a basis for settlement or for use of counsel in case of suit against the company, is held, in Re Schoepf (Ohio) 6 L.R.A.(N.S.) 325, to be a privileged communication, the production of which can not be enforced in the taking of depositions before the trial in a suit against the company for injury received in such accident.

NEW PUBLICATIONS.

AMERICAN PUBLIC WORKS ASSOCIATION—The report of the second convention of the American Public Works Association, held at Atlanta, Ga., September 14 and 15, 1906, has been published. This contains the papers read at the convention, the membership list, by-laws and association rules.

BULLETIN OF PURDUE UNIVERSITY—The annual catalogue of Purdue University, Lafayette, Ind., for 1906-1907 has been issued. This catalogue gives the courses of administration and instruction for the season of 1907-1908. There is a full description of the courses, a register of students and a list of the degrees conferred.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS—The eleventh annual report of the International Association of Municipal Electricians has been published. This report gives the proceedings of the eleventh annual convention, numerous portraits of the prominent officers, and the question box presented at the convention.

RAILWAY SIGNAL ASSOCIATION—The proceedings of the Railway Signal Association for the year 1907 has been published. This gives the reports of the meetings held during the year. The next meeting of the association will be held at the building of the American Society of Civil Engineers, 220 West Fifty-seventh street, New York city, Tuesday, May 14. The annual meeting will be held in Milwaukee, Wis., October 8 to 10.

NEW MANUFACTURING COMPANIES.

SPRINGFIELD, ILL.—The Carbon Manufacturing Company has been incorporated with a capital of $10,000 to manufacture carbons and by-products. The incorporators are Edmund M. Hybarger, Julius Broel and Warren Penwell.

BROOKLYN, N. Y.—The United States Meter Company, of Brooklyn, has been incorporated for the manufacture of meters for water, gas and electricity. The capital stock is $100,000, and the directors: Howard Marwell, John G. Buchler, James Grady, Philip Ranch and E. R. Ellsworth, all of Brooklyn.

SPRINGFIELD, ILL.—The secretary of state has issued a license to incorporate to the McDonald Electric and Supply Company, of Alton, with a capital stock of $10,000. The company will manufacture electrical supplies and machinery. The incorporators are C. H. McDonald, F. T. McDonald and J. V. E. Marsh.

JERSEY CITY, N. J.—Articles of incorporation have been filed with the county clerk by the National Railway Equipment Company, to manufacture and sell railway, freight and street-car appliances. The capital is $10,000 and the incorporators are Charles R. Barnes, Rochester, N. Y.; P. Anthony Brock and Howard C. Griffiths, Jersey City.

DETROIT, MICH.—Organized for the manufacture of "silent" car wheels, the Noiseless Car Wheel Company will locate in Detroit. Articles of association show a capital stock of $1,000,000, divided into 10,000 shares. The product of the company, it is stated, has been attracting much attention among street-car men, as it is planned to do away with several objectionable features.

ELECTRIC RAILWAYS.

OWENSBORO, KY.—The Owensboro City Railway Company will expend $50,000 this summer on improvements.

NAZARETH, PA.—A franchise has been granted to the Nazareth-Bath trolley for the use of the borough streets.

AMITYVILLE, L. I.—The village board has granted a two-year extension to the franchise of the South Shore Traction Company.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has placed an order for $900,000 worth of motors with the Westinghouse company.

AUGUSTA, ME.—The sale of the Augusta, Winthrop & Gardiner railway to the Lewiston, Augusta & Waterville street railway has been concluded by the stockholders.

MANKATO, MINN.—The city council has passed a street-car franchise granting the right to build and operate a local electric line and engage in a lighting and heating business, to W. L. Hixon and H. E. Hance, of Mankato.

ALBANY, N. Y.—The state railroad commission has granted the application of the Utica & Southern Railroad for a charter under which it is authorized to construct an electric road from Clinton to Deansboro, and from there to Waterville and Hamilton.

BUFFALO, N. Y.—President Henry J. Pierce, of the International Railway Company, announces that he has placed an order for $75,000 worth of steel rails to be laid in Chippewa, Pearl and Franklin streets. The work of building the new lines will begin in June.

BOSTON, MASS.—The railroad commissioners have authorized the Berkshire Street Railway Company to issue additional capital stock to the amount of $250,000 to pay indebtedness incurred in the construction and equipment of its road. The new stock is to be sold at par.

HUDSON, N. Y.—At the annual meeting of the Albany & Hudson Railway Company the following directors were elected: H. G. Runkle, C. L. Rossiter, A. M. Young, Henry Seibert, Foster W. Voorhees, W. E. Sheehan, R. A. C. Smith, Horace E. Andrews and Seth L. Keeney.

PHILADELPHIA, PA.—It is reported that a connection is to be built between the Philadelphia & Western and the Lancaster Traction Company, and that arrangements have been made with the McCalls Ferry Power Company to supply the current for the entire enterprise when the road is placed in operation.

BALTIMORE, MD.—At the annual meeting of the United Railways and Electric Company, the following were elected directors: H. C. Black, Alexander Brown, Frank A. Furst, William A. House, B. Howell Griswold, George C. Jenkins, Seymour Mandelbaum, Harry A. Orrick, John B. Ramsay, Douglas H. Thomas and Francis E. Waters.

BUFFALO, N. Y.—The state railroad commission has denied the application of the Buffalo-Rochester Traction Company for permission to build a trolley line connecting Rochester and Buffalo. This line was to have extended through Corfu, Batavia, Le Roy, Caledonia and Mumford to Rochester. Herbert P. Bissell was one of its principal promoters.

BALTIMORE, MD.—The Maryland Electric Railways Company has made a contract with J. G. White & Company, to supervise the electrification of the Baltimore & Annapolis Short Line Railroad. The latter was merged with the Maryland company last summer, and it was announced at the same time that it would be converted into an electric line. During the last few weeks extensive preparations have been made for starting the work.

HARRISBURG, PA.—Governor Stuart, of Pennsylvania, has signed the Homsher bill, giving trolley lines the right to do an express business and carry light freight. Light freight, according to the terms of the bill, includes farm produce, garden truck, milk and like merchandise. Local communities are permitted to impose reasonable restrictions, but, as amended, the bill carries the right on the part of the trolley companies to have the Common Pleas Court of the county review such regulations and to determine their reasonableness.

TELEPHONE AND TELEGRAPH.

STERLING, COLO.—The Postal Telegraph-Cable Company has established an office at Julesburg.

WINNIPEG, MANITOBA—The Bell Telephone will establish a telephone exchange at Fort Rouge.

AURORA, MINN.—The Mesaba Telephone Company is preparing to install an exchange in Aurora.

SARDINIA, OHIO—The People's Telephone Company has increased its capital from $5,000 to $15,000.

BEAUMONT, TEX.—An order has been placed by the Beaumont Telephone Company for apparatus for the enlarging of its exchange.

CHARLESTON, S. C.—The Western Union Telegraph Company has begun the work of putting its wires underground, as required by the city ordinances.

HUNTSVILLE, ALA.—The Postal Telegraph Company is considering the matter of extending its system to Huntsville either from Gadsden or Decherd.

SALT LAKE CITY, UTAH—Plans are said to be under way for the consolidation of the Utah Independent Telephone Company with the independent companies of Idaho and Montana.

MENA, ARK.—The farmers' telephone line at Mena has been completed. The system takes in about seven miles of territory, and among the subscribers are about 100 Polk county farmers.

HAILEY, IDA.—The Idaho Irrigation Company, Limited, has ordered from the Bell Telephone Company the wire that will be needed for a telephone system upon the Big Wood river irrigation project. This system will connect with the Bell long and short-distance lines at the town of Alberta.

CHARLESTON, W. VA.—The work of cutting over the telephone system from the old Southern Bell exchange to the company's new building on Hale street has been completed. The company has spent in the neighborhood of $200,000 for the construction of the new underground system, new equipment and the most complete building of its kind in the state.

OAKLAND, CAL.—The district south of Alcatraz avenue and north of Thirtieth street is to have a central telephone office. Work has been begun by the Pacific Telephone and Telegraph Company on a two-story, reinforced concrete building at Forty-fifth and Telegraph avenue, to cost $45,000, which will be known as the Piedmont office of the company.

OMAHA, NEB.—The Omaha Independent Telephone company, which was granted a franchise by the electors at the last fall election, has purchased of the Byron Reed Real Estate Company the ground for the site of its new central exchange building on Harney street. The property has a sixty-six-foot frontage on Harney and 147 feet on Twentieth. The company will erect a $60,000 building. The company has also purchased five lots on Twenty-fourth street, on which it will erect at once a substation to cost $12,000.

OTTAWA, QUEBEC—After prolonged negotiations, the city and the Bell Telephone Company have come to terms, and the company has been given a five-year monopoly. The city receives $5,000 a year, with the sum of $2,500 on account of the year just passed, and for which no payment has been made. A clause agreed to gives the city or a competing company the right, if desired, to erect poles and string wires any time during the last two years of the monopoly so as to be ready for business at the expiration of the grant. The rates for telephones will be $25 for house and $45 for office service. The city is given twenty free instruments.

INDUSTRIAL ITEMS.

W. S. BARSTOW & COMPANY, INCORPORATED, announces the removal of its New York offices to 50 Pine street, New York city.

THE NATIONAL ELECTRIC LAMP COMPANY, Cleveland, Ohio, announces the removal of its New York office to the fourteenth floor of the West Street Building, No. 90 West street.

THE STEEL CITY ELECTRIC COMPANY, Pittsburg, Pa., has changed its San Francisco agent from Brown, Spear, Sloane & Company to the Telephone and Electric Equipment Company.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has ready for distribution its instruction book concerning the installation and operation of its new line of direct-current motors and generators, designated as type "K."

THE CENTRAL ELECTRIC COMPANY, 264-270 Fifth avenue, Chicago, Ill., is distributing some attractive literature calling attention to General Electric fan motors, Bryant "Security Snap" sockets, and Cutter's cutout pulley.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., has ready for distribution bulletins No. 1,086, No. 1,091, No. 1,092 and No. 1,093, describing and illustrating, respectively, direct-current series enclosed arc lamp, differential type, form C; direct-current motors, type EF; type S single-phase motors; small power motors, types GA and GD.

THE ELECTRIC CABLE COMPANY, 17 Battery Place, New York city, has received an order from the New York City Interborough, for flexible mesh rail bonds, which will hereafter be used by this company. To meet the rapidly growing demand for this product the Electric Cable Company is building an extensive addition to its plant at Bridgeport, Ct.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., is calling attention to the development of the company in a neat advertising folder which it is mailing to the trade. The company announces that it has secured the entire five-story building from 483 to 489 Atlantic avenue, extending through to Purchase street, which it will connect with and occupy in addition to its present extensive quarters. This gives the company 35,000 square feet more space.

THE AMERICAN CONDUIT COMPANY, 140 Nassau street, New York city, is distributing some attractive advertising literature, including curve sheets showing the cost of cement per cubic yard of concrete, the cost of stone per cubic yard of concrete, the cost of sand per cubic yard of concrete, the cost of labor per cubic yard of concrete, specifications for Portland cement concrete, and some interesting miscellaneous advertising matter referring to the material produced by the company.

THE WESTERN ELECTRIC COMPANY, Hawthorne, Ill., is about to issue the 1907 edition of its supply catalogue. This will be a large volume of 700 pages, and will list everything of importance in the electrical line. These supply catalogues have been greatly in demand by dealers and those interested in electrical supplies all over the country. Primarily gotten up to furnish a complete list of all material handled by the company, they embody such features of general interest to the electrical trade as would make them desirable adjuncts to the literature used by purchasing agents all over the United States and Canada. Starting in the first of this year, a new organization has been instituted in the advertising department, which has been placed in charge of Howard M. Post, who had previously successfully handled the advertising for the Kellogg Switchboard and Supply Company, manufacturers of telephone apparatus; the Quincy-Manchester-Sargent Company, manufacturers of railroad supplies and machinery, and Lord & Thomas Company. It is understood that Mr. Post is instituting numerous new systems in advertising, such as have never been utilized before by that company, and that their results so far are highly satisfactory. The new catalogue will be more complete and of greater practical value than ever before.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Texas State Electric and Gas Association. San Antonio, Texas, May 14-16.

Virginia State Independent Telephone Association. Annual meeting, Norfolk, Va., May 21.

American Society of Mechanical Engineers. Annual meeting, Indianapolis, Ind., May 28-31.

International Independent Telephone Association. Chicago, Ill., June 4-6.

National Electric Light Association. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

American Railway Master Mechanics' Association. Annual meeting, Atlantic City, N. J., June 12-14.

Pacific Coast Electric Transmission Association. Los Angeles, Cal., June 18-20.

Association of Railway Telegraph Superintendents. Annual meeting, Norfolk, Va., June 19.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 20-22.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., June 25-28.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Ct.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Sadtler, 39 South Tenth street, Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings, fourth Friday of each month. Annual meeting, Niagara Falls, N. Y., June 25-28.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill. Annual meeting, Atlantic City, N. J., June 12-14.

AMERICAN ROENTGEN RAY SOCIETY. Secretary, Dr. G. C. Johnston, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 20-22.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Fifty-seventh street, New York city. Annual convention, Mexico City, Mexico, beginning July 8.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 12 West Thirty-first street, New York city. Next meeting, Indianapolis, Ind., May 28-31.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, assistant treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, S. W. Mower, London, Canada.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Spead, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Ernest H. Davis, Williamsport, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Annual meeting, Atlantic City, N. J., June 19-20, 1907.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, P. C. Brown, Boston, Mass.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, president Toronto Suburban Railway, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, W. F. Millholland, secretary and treasurer Indianapolis Traction and Terminal Company, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. F. Dostal, Denver, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Ct.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York city.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Roland A. Davidson, 58 William street, New York city.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Texas.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.; assistant secretary, J. A. Harney, Electric Building, Cleveland, Ohio.

IOWA STATE ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

KANSAS GAS, WATER AND ELECTRIC LIGHT ASOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., October 16, 1907.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. S. Vivian, Grand Rapids, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James F. Barnett.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee street, Utica, N. Y. Next meeting, New York city, July 17, 1907.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. N. Kimball, Kenosha, Wis. Next annual meeting, Milwaukee, Wis., January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual meeting, Toledo, August 20, 21 and 22.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore. Annual meeting, Los Angeles, Cal., June 18-20.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Annual meeting, Milwaukee, Wis., October 8-10, 1907.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Annual meeting, Atlantic City, N. J., June 19-20.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, So. Dak.

SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION. Secretary, Frank C. Duffey, Beaumont, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, general manager Rochester and Eastern Rapid Railway, Canandaigua, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Tex.

TEXAS STATE GAS AND ELECTRIC ASSOCIATION. Secretary, A. S. Sticher, Dallas, Tex. Next meeting, San Antonio, Tex., May 14-16.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va. Annual meeting, Norfolk, Va., May 21.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, Chicago.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

Record of Electrical Patents.

Week of April 30.

851,645. RAIL JOINT. Leandre Boudreaux, Thibodaux, La., assignor of one-half to Joseph A. Naquin, Thibodaux, La. A rail joint with openings in the web and a flat plate extending under the rails provided with openings engaging the spikes driven through the openings in the rails.

851,654. FOUR-WAY SNAP SWITCH. Nathan W. Crandall, Hartford, Ct., assignor to the Perkins Corporation, Hartford, Ct. A snap switch with four pairs of stationary spring contacts, a pair of oscillating poles arranged to be thrown between pairs of stationary contacts.

851,655. ELECTRIC HORN. Henry Csanyi, Orange, N. J. An electric horn with tapering mouthpiece, an electromagnet and a diaphragm located between the electromagnet and the outlet of the mouthpiece.

851,658. REACTANCE COIL. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A reactance coil with magnetizable end rings interconnecting the coils on the core members, and a supporting frame of non-magnetizable material.

851,662. CONTROLLING APPARATUS FOR ELECTRIC MOTORS. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A controller for connecting the main windings of an induction motor in series for starting and in parallel for running, and means for opening the main circuit when the working current is cut off.

851,663. ELECTROMAGNET. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A core structure for electromagnets.

851,664. SYSTEM OF CONTROL. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A system of translating devices, a plurality of voltage regulators and means for operating the same.

851,665. VOLTAGE-ADJUSTMENT MEANS. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A combination of a series of conductors supplied with progressively differing voltages.

851,666. VOLTAGE REGULATOR. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A distributing circuit and a transformer winding having leads extending from several points thereof, and means for connecting the windings between different transformer leads.

851,667. RESISTANCE TERMINAL. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A combination of resistance frame and resistance units.

851,671. SUPPORTING DEVICE FOR ELECTRIC CONDUCTORS. Budd J. Jones, Chicago, Ill., assignor to Westinghouse Electric and Manufacturing Company. A supporting arm or bracket, an adjustable insulator for supporting electrical conductors.

851,682. ELECTRICALLY CONTROLLED ELEVATOR. William D. Lutz, Allendale, N. J. An electrically controlled elevator door lock, and means for starting the elevator by the movement of a portion of the lock.

851,685. VACUUM-TUBE LIGHTING. Daniel M. Moore, Newark, N. J., assignor to Moore Electrical Company, New York, N. Y. A series of unit vacuum tubes with their contiguous ends enclosed in danger-proof boxes.

851,690. ELECTRIC SWITCH MECHANISM. Frank C. Newell, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. An electromagnetically operated switch mechanism.

851,692. AUTOMATIC BLOCK-SIGNAL SYSTEM. Frank P. J. Patenall and George H. Dryden, Baltimore, Md. A block-signal system with normally closed rail circuits.

851,695. ROTARY-CONVERTER SYSTEM. Walter S. Rugg, New York, N. Y., assignor to Westinghouse Electric and Manufacturing Company. A combination of a rotary converter and rheostat for varying the field magnetization.

851,702. ROTARY DRESSING DEVICE. Vinzenz Spietschka, Cleveland, Ohio. A rotary dressing device with means for carrying various dressing instruments and means for regulating the cut of these instruments.

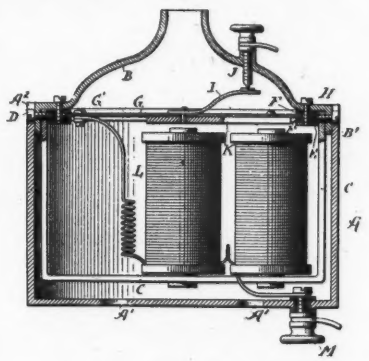
851,704. METHOD OF SPEED REGULATION. Norman W. Storer, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Method of speed regulation, consisting of connecting a large capacity motor in series with a small capacity motor.

851,705. INSULATOR. Hugo Stotz, Mannheim, Germany. A combination of a socket fitted into a tubular support and a drip-bell.

851,709. POTENTIAL REGULATOR. Wilbur H. Thompson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A transformer regulator, relatively movable coils and a fluid pressure actuating device.

851,719. CONDENSER-PUMP REGULATOR. Ragnar Wikander, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. A steam-driven engine, a condenser, a pump for supplying condenser water, with electric motor for driving the pump.

851,726. SERVICE ENTRANCE BOX. Frederick B. Adam, St. Louis, Mo., assignor to Frank Adam Electric Company, St. Louis, Mo. A hollow rectangular member adapted to be inserted in the wall of a building.



851,655.—ELECTRIC HORN.

851,738. METHOD OF AND APPARATUS FOR TRANSFORMING SINGLE OR POLYPHASE INTO CONTINUOUS CURRENT. George Faget, Paris, France. Apparatus for transforming either single or polyphase current into continuous current of variable voltage.

851,739. PROTECTION OF SECONDARY CIRCUITS. Samuel Ferguson, Schenectady, N. Y., assignor to General Electric Company. Means for automatically interconnecting low and high-potential conductors, and grounding system.

851,743. VARIABLE-VOLTAGE TRANSFORMER. Edward F. Gehrkens, Schenectady, N. Y., assignor to General Electric Company. A variable-voltage transformer with a third coil in inductive relation to the primary, and connected in series with the secondary.

851,747. PROCESS OF DRYING ELECTRIC CABLES. William B. Hale, Mexico City, assignor to Western Electric Company, Chicago, Ill. A process for drying electric cables.

851,751. JUMP-SPARK INDICATOR. Otto C. Hoffmann, Buffalo, N. Y., assignor to Chicago Fuse Wire and Manufacturing Company, Chicago, Ill. A jump-spark device located in the shunt of a non-inductive electric conductor.

851,761. TELEPHONE SWITCH HOOK. Alfred Larson, Buffalo, N. Y. A tilting bridge carrying a set of contacts, and a plunger bearing upon one of these contacts.

851,762. CONTROLLING MEANS FOR AUTOMOBILES. Hermann Lemp, Lynn, Mass., assignor to General Electric Company. An electric driving and controlling system for automobiles.

851,775. ELECTRIC ATTACHMENT FOR TANKS. Henry E. Reeve, Brooklyn, N. Y., assignor to Automatic Fire Alarm Company, New York, N. Y. A float attachment for fluid tanks.

851,776. AUTOMATIC TRAIN-BLOCKING SYSTEM. Charles E. Roehl, Brooklyn, N. Y. A track signal circuit governed by a power circuit.

851,786. CONTROLLING SWITCH FOR TRANSFORMERS. Matthew O. Troy, Schenectady, N. Y., assignor to General Electric Company. A combination of a supply circuit, a transformer, a translating device, and a switch adapted to connect the transformer primary to the supply circuit.

851,792. TELEPHONE-EXCHANGE SYSTEM. Johan A. Avén, Stockholm, Sweden, assignor, by mesne assignments, to the firm of Deutsche Telephonwerke Gesellschaft mit Beschränkter Haftung, Berlin, Germany. A call distributing system.

851,793. BRUSH HOLDER. Ralph E. Barker, Lynn, Mass., assignor to General Electric Company. A casing or supporting member provided with two sockets and brushes eccentrically mounted in bushings.

851,795. RELAY. Elmer F. Bliss, Schenectady, N. Y., assignor to General Electric Company. A relay winding operated by two intersecting arcs.

851,797. CLUTCH MECHANISM. Tito L. Carbone, Berlin, Germany. An arc lamp clutch mechanism.

851,799. ELECTRIC TRACTION SYSTEM. Alexander Churchward, Schenectady, N. Y., assignor to General Electric Company. An electric traction system with a self-contained generating and motor system.

851,803. TELEPHONE TRUNKING SYSTEM. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A combination of trunk line and calling system.

851,804. CONTROLLER FOR ELECTRIC MOTORS. Charles A. Dresser, Chicago, Ill., assignor to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. A series of resistance contacts for two or more motors.

851,808. AUTOMATIC SWITCH FOR ELECTRIC CIRCUITS. Charles H. Hill, Schenectady, N. Y., assignor to General Electric Company. An automatic means for actuating one set of switches in case of failure of voltage in the motor circuit.

851,811. AUTOMATIC MOTOR STARTER. Charles D. Knight, Schenectady, N. Y., assignor to General Electric Company. A latch adapted automatically to engage and release a member to deenergize a magnet winding.

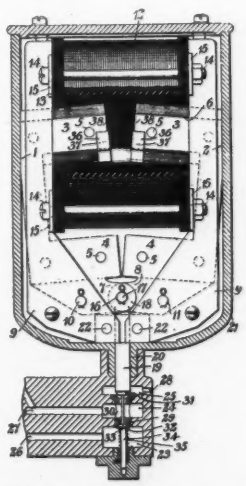
851,822. CABLE CLAMP. Alfred H. Meech, Chatham, N. Y. A cable clamp.

851,823. SYSTEM OF MOTOR CONTROL. Wilbur L. Merrill, Schenectady, N. Y., assignor to General Electric Company. Means for controlling a plurality of motors in series to a source of current, and means for connecting an individual motor to this source independently of the other motors.

851,828. ALTERNATING-CURRENT MACHINERY. Addams S. McAllister, New York, N. Y. Means for preventing sparking with an alternating-current commutator machine.

851,829. ELECTRICALLY CONTROLLED ELEVATOR. Carl Naujoks and Frederick C. Naujoks, San Francisco, Cal., assignors of one-ninth to George Goeppert, one-ninth to Ballo Bruetting, and one-ninth to Victor Mockel. A combination of means for raising and lowering an electric elevator and a controller circuit.

851,838. CIRCUIT FOR COIN COLLECTORS. John G. Roberts, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. A circuit with a portion divided into two parallel branches, a source of direct and alternating current, and a means for preventing alternating current from producing an operative difference of potential whereby the magnet responds only to direct current.



851,663.—ELECTROMAGNET.

851,856. MEANS FOR NULLIFYING INDUCTIVE INTERFERENCE BETWEEN PARALLEL CIRCUITS. Edward Blakeney, Ossining, N. Y., assignor to American Telephone and Telegraph Company. A method of nullifying inductive disturbances of one telegraph line upon another.

851,890. METHOD OF STARTING ALTERNATING-CURRENT MOTORS. Waldo A. Layman, St. Louis, Mo. A voltage regulating system for starting alternating-current motors.

851,891. METHOD OF ELECTRICALLY BRAKING ALTERNATING-CURRENT MOTORS. Waldo A. Layman, St. Louis, Mo. An electrical method of braking an alternating-current motor.

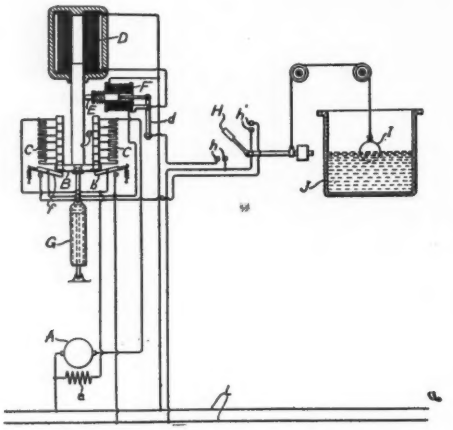
851,933. ELECTRIC-ELEVATOR CONTROLLER. Howard F. Gurney, Jersey City, N. J. A starting and reversing switch and electric-elevator controller.

851,934. ELECTRIC ELEVATOR. Howard F. Gurney, Jersey City, N. J. A combination of a hoisting mechanism, a motor, a starting and reversing switch, and an automatic rheostat.

851,948. TELEPHONE SYSTEM. Jacob W. Lattig and Charles L. Goodrum, Philadelphia, Pa. A combination of a multiple switchboard, telephone line, line conductors and battery.

851,961. ELECTRIC FURNACE. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. An electric furnace.

851,975. INCANDESCENT-LAMP SUPPORT. Edmond Beaudette, Montreal, Quebec, Canada. A canopy containing a rotatable spindle.



851,811.—AUTOMATIC MOTOR STARTER.

851,976. ELECTRICAL MEASURING INSTRUMENT. Adelbert O. Benecke, Vailsburg, N. J. An electrical measuring instrument with a duplex air chamber and a two-part vane or fan.

851,979. ELECTROMAGNETIC SEPARATOR. William Blackmore, London, England. A magnetic ore wet separator.

851,994. TELEPHONE SWITCH. Timothy S. Mount, Rhome, Tex. A telephone box provided with transmitting, ringing and switching mechanism.

851,997. FUSE HOLDER. John C. Ralls, Los Angeles, Cal., assignor of one-fourth to Edward J. Fleming and one-fourth to Paul Usser, Los Angeles, Cal. A fuse holder with means for making connection with a wire.

852,004. AUTOMATIC TELEPHONE-SWITCH SYSTEM. John Wicks and Donald D. McKay, Riverside, Cal. An automatic telephone-exchange system.

852,026. PROTECTION OF ELECTRICAL SYSTEMS FROM LIGHTNING AND OTHER STATIC DISTURBANCES. Ralph D. Mershon, New York, N. Y. A conductor of diminished electrostatic capacity and one or more arrester devices connected to the conductor and to ground.

852,027. ALTERNATING-CURRENT MACHINES ON SINGLE-PHASE CIRCUITS. Ralph D. Mershon, New York, N. Y. A combination of a primary element of an alternating-current machine, a reactance, and a capacity connected to the primary element.

852,028. ELECTRIC MOTOR AND OTHER APPARATUS IN WHICH THERE IS MAGNETIC FLUX. Ralph D. Mershon, New York, N. Y. An annular element of polygonal cross-section, with windings on the opposite plane sides of the element.

852,037. SAFETY-FUSE TERMINAL. Joseph Sachs, Hartford, Ct., assignor to the Sachs Company, Hartford, Ct. An end cap, a contact terminal, and lugs providing integral attachment of the fuse terminals.

852,081. TELEPHONE HOLDER. Thomas J. Skelley, Collinwood, Ohio, assignor to Skelley & Company, Cleveland, Ohio. A telephone holder with a pivoted bracket arm.

852,092. ELECTRICALLY CONTROLLED SEMAPHORE SIGNAL. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. An electrically controlled semaphore signal with a rotatable friction brake.

852,093. RAILWAY SEMAPHORE SIGNAL. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. An electrically controlled and operated railway semaphore signal with a revolving fan operated by the movement of the semaphore blade.

852,094. RAILWAY SEMAPHORE SIGNAL. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. An electrically operated and controlled signal with rotatable pneumatic means to prevent a jar.

852,121. INCANDESCENT-LIGHT ATTACHMENT. William V. D. Kelley, Newark, N. J., assignor of one-half to Howard S. Jones, Brooklyn, N. Y. An advertising device for attachment to incandescent lamp bulbs.

852,133. ELECTROTHERAPEUTICAL INSTRUMENT. James W. Molière, Oakland, Cal. An ozone producing device.

852,148. WIRE CONNECTOR. Joseph S. Tucker, Chicago, Ill., assignor of one-third to Samuel N. Pond, Morgan, Park, Ill. A connection piece with a slotted centre for holding the bent ends of a wire.

852,186. ELECTRICAL-CURRENT INTERRUPTER. Frederic W. Lord and Frederic W. Erickson, New York, N. Y. A casing containing liquid insulation supporting and enclosing spark-gap electrodes adapted to be arranged in series from the line wire to the ground.

852,188. DRY BATTERY. Clay D. Manville, Pittsburg, Pa., assignor of one-half to Julius Baer, Pittsburg, Pa. A casing and a battery arranged therein, and a coil spring within the casing below the battery.

852,193. ELECTRIC EXERCISING APPARATUS. Archie B. McMillan, Brooklyn, N. Y. An exercising apparatus in connection with a generator and a ground plate.

852,206. RAIL-JOINT CHAIR. George W. Strother, Jenifer, Ala., assignor of one-half to John H. Wilson, Jenifer, Ala. A rail splice, consisting of splice bars disposed upon opposite sides of the rail joint.

852,210. RAIL JOINT. Vinton C. Young, Verona, Mo. A rail joint comprising splice bars with vertical flanges secured to the webs of the rails.

852,216. WIRE SPLICER. Eli Bowman, Arlington, Ohio. A rotatable wire splicing mechanism.

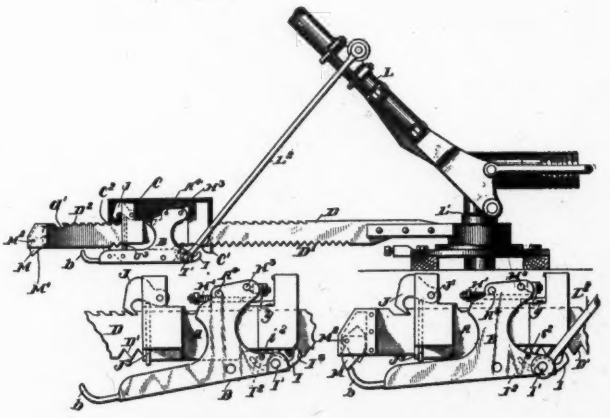
852,226. BURGLAR-ALARM RELAY DROP. David D. Friedman, New York, N. Y. An open-circuit relay drop.

852,265. HEADLIGHT. Manes E. Fuld, Baltimore, Md. A portable headlight for attaching to the forehead.

852,279. ELECTRIC DOOR-OPENER. Joseph Loch, Brooklyn, N. Y. An electric door-opener.

852,307. TROLLEY-POLE CATCHER. John H. Walker, Lexington, Ky. A combination of a trolley pole and a carrier with a rocker arm and dog for engagement with the carrier.

852,338. ELECTRIC STOVE. Albert L. Marsh, Lake Bluff, Ill., assignor to Hoskins Co., Chicago, Ill. A combination of a block of refractory material and coiled electrical resistances.



852,307.—TROLLEY-POLE CATCHER.

852,342. ELECTRIC GAS-IGNITER. Franklin C. Nickel, John E. Martin and Charles E. Blackburn, Jacksonville, Ill. An igniter with a resilient stem integral with the fixture tongue.

852,344. SUPERVISORY SIGNAL SYSTEM. Charles F. Patterson, New York, N. Y. A supervisory signal system comprising receiving means, circuits and a plurality of transmitters.

852,381. WIRELESS TELEGRAPH RECEIVING SYSTEM. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. A tuned receiving circuit.

852,386. HAND-OPERATED ELECTRIC-CIRCUIT CONTROLLER. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Means for automatically returning a rotatable shaft to a predetermined position.

852,405. RAILWAY SIGNALING APPARATUS. Edson R. Wolcott, Golden, Col. A combination of one or more conductors mounted in suitable proximity to the track, and a train having an instrument inductively sensitive to the signal apparatus.